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# Félix Savart (1791-1841), Physician-Physicist

## Early Studies Pertinent to the Understanding of Murmurs

VICTOR A. McKUSICK and
H. KENNETH WISKIND*

PIONEER acoustician, Félix Savart (1791-1841) made studies of the generation of sound in flowing liquids. He analyzed the factors influencing the generation of "fluid veins," a process we would be likely to refer to today as "vortex shedding" or merely "turbulence." In the latter half of the nineteenth century, in medical and physiological writings on the genesis of heart murmurs, Savart's "fluid veins" were repeatedly referred to. When it was realized that, in the case of partial obstruction to the flow of blood, the murmur is produced not at, or proximal to, the site of obstruction but in the fluid beyond, it was presumed that a mechanism like that revealed by Savart was involved. Comparable writings today are along similar lines, but "eddy," "vortex," and especially "turbulence" are the words more likely to be used, and the name of Savart is known to few. Although Savart was educated for a career in medicine, it is not certain, as will be discussed later, to what extent his studies of sound production in fluids was motivated by an interest in the mechanism of heart murmurs.

### Family and Education

Savart[3, 7, 8, 17, 19] was born in Mézière, France, on 30 June 1791. (A street in Mézière is named in his honor.[1]) His early schooling was obtained in Metz where his father, Gerard, was in charge of the draftsmen in the artillery school. His father was an ingenious man who, among other accomplishments, had invented a clever instrument for dividing circles. From his father, Savart acquired the flair for the precise mechanical arts which was so essential to him in his subsequent career as an experimentalist.

Nicolas Savart, grandfather of Félix and a native of Mézière, was associated with the engineering school of that city from its founding in 1748. He was *préparateur*, or assistant, to Abbé Nollet

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(1700-1770), the famous physicist, who commended him highly in one of his writings.

An uncle, Nicolas Pierre Antoine Savart (1765-1826), was for a long time adjutant to Lafayette and was later professor of fortifications at St. Cyr. He wrote a textbook on fortifications which went through several editions. A brother of the subject of this piece, also Nicolas Savart (1790-1853), was, like his father and uncle, an officer of the engineering corps of the French army. He published at least four papers on acoustical topics.[27]

Contrary to his early training and family background, young Félix Savart decided on a medical career and about 1808 entered the hospital in Metz. From 1810 to 1814 he served as a regimental surgeon in Napoleon's armies, specifically in the first battalion of engineers. After discharge from the army, he completed his medical training in Strasbourg, where he received his doctor's degree in October 1816. The title of his doctorate thesis was "Du cirsocele." The mundane topic of varicocele must have had little intrinsic appeal for him, and it is perhaps slight wonder he did not stay in medicine. He remained in Strasbourg for another year, extending his medical experience and preparing a translation of Celsus. It is possible that his interest in Celsus (2d century A.D.) developed from study of Celsus' writings on varicocele.

In 1817 Savart returned to Metz with the intention of establishing a medical practice. There he found himself again among physical scientists. In the period when patients were slow in coming he spent his time "more in fitting out a laboratory and building instruments than in seeing sick people and perusing Hippocrates."[3] It was during this period that he conceived and constructed a scientifically designed violin and began to devote himself specifically to the study of acoustics, a subject which engaged his attention almost exclusively for the remainder of his life.

## THE INFLUENCE OF MEDICINE IN THE CAREER OF SAVART AND OTHER PHYSICISTS

There is evidence in some of Savart's later writings (*Recherches sur les usages de la membrane du tympan et de l'oreille externe*, 1824; *Sur la voix humaine*, 1825; *Sur la voix des oiseaux*, 1826) that his medical background influenced his choice of problems for investigation. Anatomical sketches of the human larynx and the syrinx of birds accompany certain of these papers. Savart's experiments on sound production by the efflux of fluid through a small

orifice have medical implications (see later). As Helmholtz stated in his *Thought in Medicine*:[15] "Medicine was the intellectual home in which I grew up; even the emigrant best understands, and is best understood by, his native land." Savart's career bears certain resemblances to that of Helmholtz (1821-1894). As a 26-year-old regimental surgeon, Helmholtz made contributions to the theory of the conservation of energy,[11] which has assumed such fundamental importance in thermodynamics and other branches of science.

The career of Thomas Young (1773-1829), of "modulus" fame, bears both similarities to and differences from Savart's. As recounted in Alexander Wood's thoughtful and fascinating biography,[31] Young had an unusually fine medical education at London, Edinburgh, Göttingen, and Cambridge, was an active practitioner for his entire career, and lectured and wrote prolifically on medical subjects.[32,33] His discovery of the role of the lens of the eye in accommodation dated from his early medical student days. He invented an "eriometer"[5] for measurement of average diameter of the red cells of the blood.[33] On 5 May 1808, Young read a paper to the Royal Society called "Hydraulic Investigations," and on 10 November of the same year delivered the Croonian Lecture "On the Function of the Heart and Arteries." Wood[31] states that Young published the results of some of his early physical studies anony mously out of fear of injuring his medical reputation!

A third career with certain parallels to Savart's is that of his contemporary Jean-Léonard-Marie Poiseuille[4,18,19] (1799-1869), who had had excellent training in mathematics and physics before taking his doctorate in medicine in 1828. His medical thesis, of outstanding historical import, described the design and use of an instrument for measuring blood pressure in animals. The instrument was essentially a mercury-filled U-tube. Poiseuille's memoir was published in the *Journal*[20] which the physiologist Magendie produced for about ten years. In later stages of his career Poiseuille turned his attention increasingly to problems more physical than physiological. A most significant contribution was his description of the movement of liquids through tubes of small diameter.[21,22] These experiments, first described to the Académie des Sciences on 14 December 1840,[21] were the basis for the law which bears his name, or sometimes those of Hagen* and Poiseuille jointly.

* Gotthilf Heinrich Ludwig Hagen (1797-1884) can also be credited with recognition (about 1854) of the transition from laminar to turbulent flow as an important phenomenon of hydrodynamics. Although he recognized temperature-dependence, he did not relate the observation to viscosity, a relationship elucidated by Osborne Reynolds in the 1880's.[15a]

## CAREER IN PARIS

In 1819 Savart went to Paris to publish his translation of Celsus' great treatise *De medica*** and to consult Jean-Baptiste Biot (1774-1862) in connection with his study of the acoustics of musical instruments. This was undoubtedly a turning point in Savart's career. Biot encouraged and aided Savart in many ways and took him into collaboration in a study of electricity. When Savart arrived in Paris, Biot was, by chance, lecturing on acoustics at the Faculty of Sciences. Biot recognized the worth of Savart's acoustical investigations and immediately incorporated the results in his lectures. Furthermore, he introduced to the Académie des Sciences Savart's memoir on the construction of bowed string instruments.

The collaboration resulted in the law of Biot and Savart[2] which describes the electromagnetic force field around a straight current-carrying conductor of infinite length. Early in 1820 Hans Christian Oersted (1777-1851) of Copenhagen had found that a compass needle placed in the vicinity of a wire carrying current from a battery became oriented at right angles to the wire. At a meeting of the Académie des Sciences on 30 October 1820,[15,28] Biot and Savart reported confirmation of Oersted's finding with a detailed analysis of the phenomenon.

Possibly Biot's greatest contribution to science was the encouragement he gave to promising young men whose worth he seems to have had an uncanny ability to recognize. This, combined with complete unselfishness, resulted in Biot's fostering several of the leading French scientists of the last century. Louis Pasteur is another outstanding case in point.

Biot, who had himself made contributions to the field of acoustics, encouraged Savart in his physical researches and aided him in obtaining academic appointments which allowed him to pursue his investigations. From 1820 to 1827 Savart taught sciences in a private school in Paris. On 5 November 1827 he became a member of the section on general physics of the Académie des Sciences. About the same time he succeeded André Marie Ampère (1775-1836), the "Newton of electricity," as professor of experimental physics and conservator of the physics cabinet in the Collège de France. These posts Savart (Fig. 1) held until his untimely death on 16 March 1841 at the age of fifty years.

** Many editions of Celsus have appeared but no translation by Savart. Other matters must have engaged his attention to the exclusion of this interest in the classics.

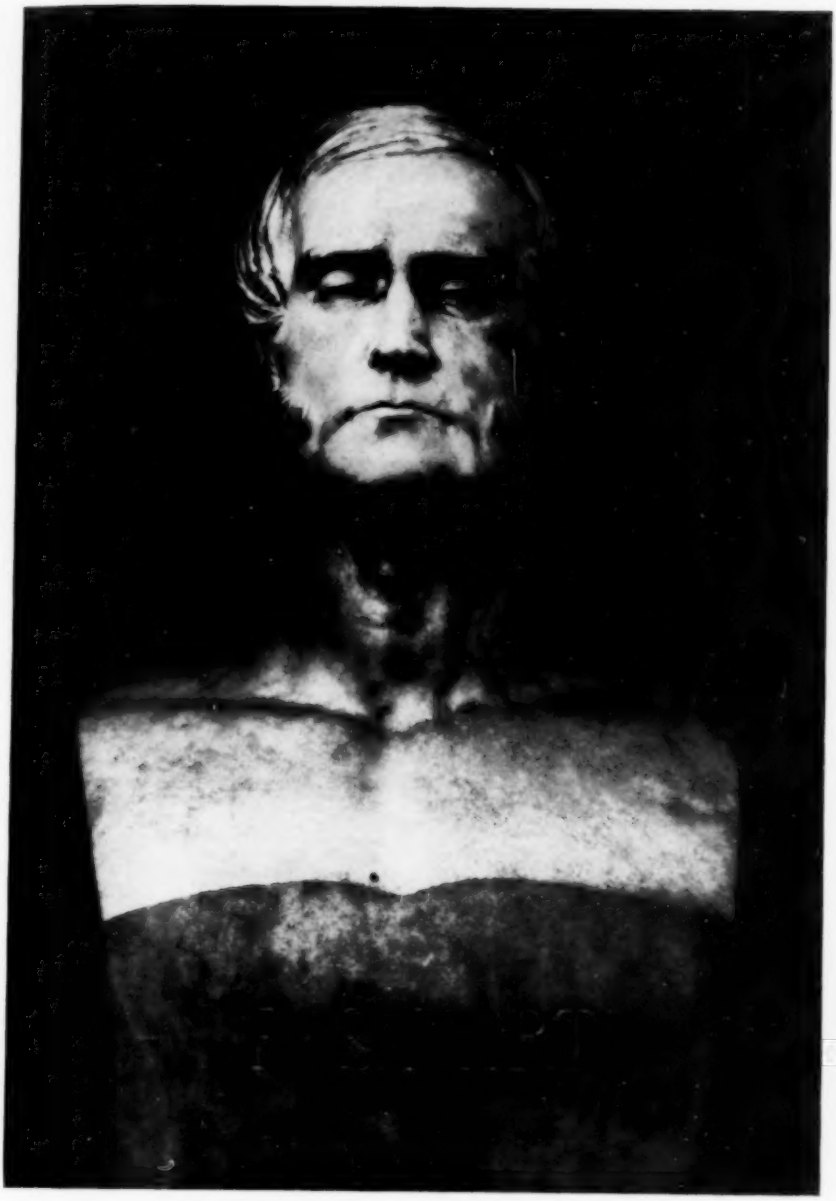
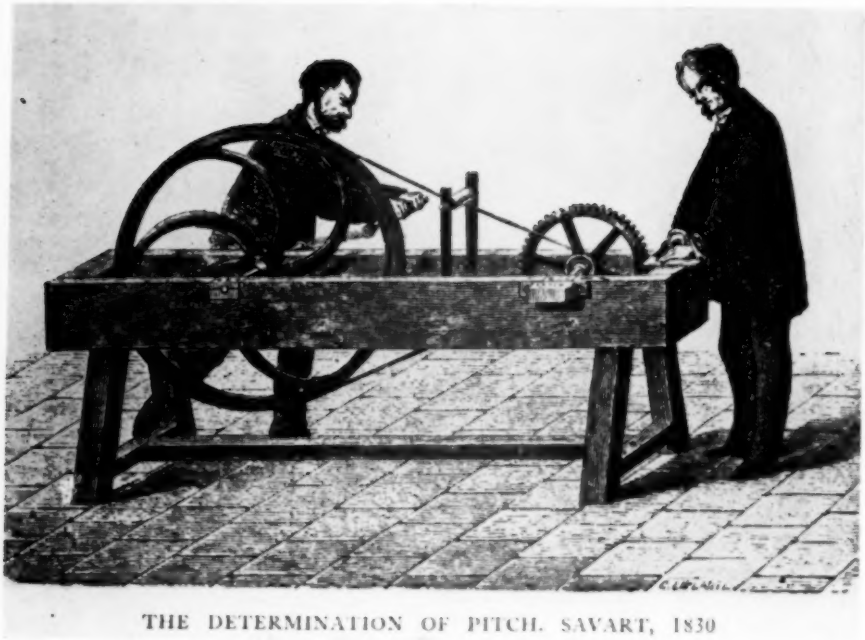


FIG. 1. Bust of Savart. Académie des Sciences, Paris.



THE DETERMINATION OF PITCH. SAVART, 1830

FIG. 3. Savart's wheel.

## Acoustical Investigations

Heller[8] referred to Savart's memoir on the construction of bowed string instruments (1819) as a "truly classical piece." It is clearly the grandfather of investigations of the physics of music and musical instruments. Savart had been much attracted by the work

# MÉMOIRE

SUR LA CONSTRUCTION

# DES INSTRUMENS

## À CORDES ET À ARCHET,

LU A L'ACADÉMIE DES SCIENCES, LE 31 MAI 1819,

*Suivi du Rapport qui en a été fait aux deux Académies des Sciences et des Beaux-Arts, par MM.* Haüy, Charles, de Prony, Chérubini, Catel, Berton, Le Sueur, Biot, *Rapporteur;*

PAR FÉLIX SAVART,

DOCTEUR EN MÉDECINE,

CORRESPONDANT DE LA SOCIÉTÉ PHILOMATIQUE.

A PARIS,

CHEZ H. ASSELIN, LIBRAIRIE POUR LES SCI^N. 8;

QUAI DES-AUGUSTINS, 31.

1819.

FIG. 2a. Frontispiece of Savart's publication on the physics of string and bowed instruments.[25]

of Ernst F. F. Chladni (1756-1827), a great pioneer experimental acoustician, and through Chladni to the field of acoustics in general. He modified and used some of Chladni's experimental techniques such as his use of fine powder to demonstrate patterns of vibrations, so-called Chladni figures (1787).

The memoir of 1819 (see Fig. 2A for view of the frontispiece) was based on studies of the physics of the violin and described the construction of a violin which was intended to be acoustically superior to the empirically designed instruments. This was the trapezoid violin (see Fig. 2B) known in England as the "box fiddle." Savart had shown that a flat piece of wood vibrates in simpler modes than an arched one and that straight holes are preferable to

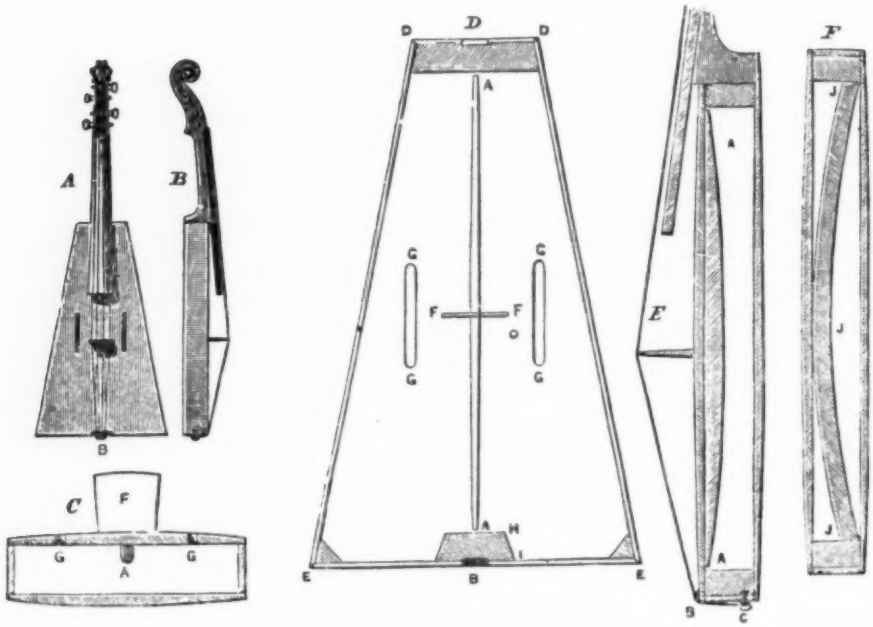



FIG. 2b. Sketch of the box, or trapezoid, violin of Savart.[25]

the usual *f* holes. The optimum position for the holes was ascertained by careful experiments. These and other features were incorporated in the new design.

Savart made studies of the natural frequency of violins, specifically Stradivari. As Helmholtz[9] stated, "an inclosed mass of air, like that of the violin, viola, and violoncello, bounded by elastic plates, has certain proper tones which may be evoked by blowing across the openings, or '*f* holes.'" This was the method used by Savart who determined a natural tone of c′ for the famous violins.

A joint commission comprising four members of the Académie des Sciences and four of the Académie des Arts convened to judge the performance of Savart's violin with that of a Stradivarius when

both were played by an accomplished artist. The report of the commission, which concluded, in brief, that Savart's violin was as good or better than the old master, is printed in Savart's monograph.

About 1830 Savart invented a toothed wheel for determining the number of vibrations in a given musical tone. He attached tongues of pasteboard to the hoop of the wheel and arranged for these to strike a projecting object as the wheel was turned. Alternately, as shown in Figure 3, he had cogs of a wheel strike a tongue of pasteboard. Presumably he employed this instrument to determine the vibrations per second of the tones he elicited from his experimental models. He would speed up the rotation of the wheel until a tone which matched the experimental one was produced. Since the frequency of the tone produced by the wheel could be easily determined, the frequency of the unknown tone produced by the model was ascertained. By an extension of this method, Savart compounded musical notes. For example, he would use, in combination, wheels with numbers of teeth which bore a simple relationship to each other. He used this method to explore the physical basis of harmonious and discordant sounds.

Savart put his wheel to further use in determining the frequency limits of audibility of sounds for the human ear. He set the low and high values at 8 and 24,000 cycles per second, respectively. These figures represent a wider range than is generally accepted today. However, the values he determined are of the same order of magnitude as the 16 to 16,000 cycles per second one usually hears quoted now.

Although Savart may have had an unusually sensitive ear, a more likely explanation is provided by Helmholtz[10] who pointed out that by the nature of the Savart sound-maker strong overtones were likely to be produced at low frequencies. It was probably the overtones that Savart was hearing at the lower limit. If subharmonics were also generated in his system, an explanation for the unusually high upper limit is likewise provided.

The so-called Savart's wheel, although possibly original in Savart's mind, had been devised in crude form by Robert Hooke in 1681. In Waller's biography of Hooke,[28] it is recorded that in July of that year Dr. Hooke showed at the Royal Society "a way of making musical sounds by the striking of the teeth of several brass wheels proportionally cut as to their numbers, and turned very

fast round, in which it was observable that the equal or proportional strokes of the teeth, that is, 2:1, 4:3, &c., made the musical notes."*

Determination of frequency by the siren (so-called because it was found that it could "sing under water") also preceded Savart's wheel. The siren is usually credited to Baron Charles Cagniard de la Tour (1777-1859) who in 1819 built a device consisting merely of a disc, with a circle of perforations, rotating steadily in front of an air jet.

Savart's name is memorialized by being attached,[30] in a manner comparable to the names of Ohm, Ampère, Watt, Coulomb, Joule, Henry, Faraday, Bell, Gauss, Poiseuille, Stokes, Maxwell, Volta, and others to a physical unit, in Savart's case an acoustical unit. Experiments of Knudsen[30] and others have shown that the ratio of the minimum perceptible change in frequency to the frequency level at which the measurement is made is a constant over the range of 500 to 4,000 c.p.s. The savart is a unit related to the perceptible change in frequency; 300 savarts are approximately equal to one octave. However, this unit has not enjoyed general acceptance and usage.

Also in the acoustical field, Savart performed experiments[26c, j, x] on the longitudinal vibrations of rods, with particular reference to the sounds related to these vibrations and on the vibrations of plates. In connection with the last he published[26c] a large number of Chladni figures. He investigated the motion of air within organ pipes[26b] by lowering into the vertical pipe a small stretched membrane on which a little sand was scattered. By this ingenious method, also adapted from Chladni (1787), he could identify the nodes and antinodes. The particles of sand were quiet at the antinodes, or loops, but began to dance vigorously as a pressure node was approached. Savart found that a very fine powder such as lycopodium, when substituted for sand, collected at the antinodes of the vibrating plate, not the nodes. Faraday[6] thought this was due to currents in the ambient air which was also in vibration; in vacuum the anomalous behavior was not observed and all powders collected at the nodes.

* Incidentally, Hooke (1635-1703) made his own contribution to the field of cardiovascular sound when he wrote the following[13]: "I have been able to hear very plainly the beating of a Man's heart . . . Who knows, I say, but that it may be possible to discover the Motions of the Internal Parts of Bodies—by the Sound they make, that one may discover the Works performed in the several Offices and Shops of a Man's Body, and thereby discover what Instrument or Engine is out of order." Here Hooke both described the phenomenon, even the existence of which had been questioned hitherto, and speculated on its practical usefulness.

A biographer of Savart, writing in Grove's *Dictionary of Music and Musicians,* makes the following summary of Savart's work in acoustics: "In general he threw light on the nature of the complicated relation between a vibrating body which is the source of sound and other bodies brought into connection with it, by virtue of which the original sound is magnified in intensity and modified in quality, well known examples of such an arrangement being furnished by the sounding board of the violin tribe and the pianoforte."

## Experiments Relevant to Cardiovascular Sound

The experiments which have most bearing on cardiovascular sound were those which concerned jets, particularly their acoustic properties. These experiments were performed in the last ten years of his life. In fact, certain experiments concerned with jet sound, probably his last, were reported posthumously in 1853 to the Académie des Sciences by Arago, successor to Savart's post, in the name of the brother N. Savart.[26bb] In London the report was republished, with omission of the tables of data, in the *Philosophical Magazine.*[26aa] In 1833 Savart[26u-w] had already published important observations on jet flow, including preliminary experiments on sound generation in jets.

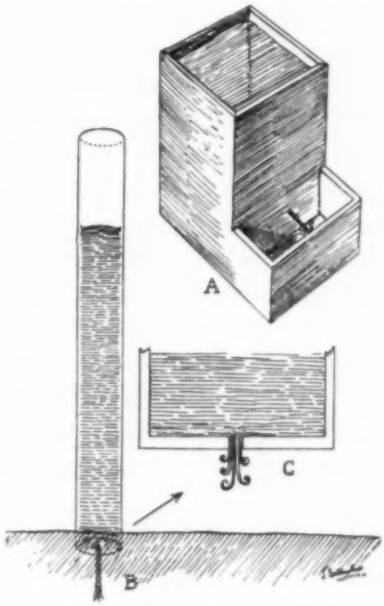



Fig. 4. Modern artist's conception of two of Savart's model experiments, which pertain to the subject of murmur production.

In these experiments Savart studied the sound generated by a water jet issuing from the orifice at the bottom of a tall cylinder which acted as reservoir (see Fig. 4). Sound was produced when the end of the tube was either in air or in water. The interesting feature of this arrangement lies in the fact that a pure tone is generated and that the pitch of the tone rises as the height of the water in the tube recedes. Furthermore, as the water level falls in the tube there are relatively silent intervals between periods of maximal acoustic power. Savart made extensive investigations of the influence of variable diameters and lengths of tube and various diameters of orifice. It appears that the basic mechanism of this sound gen-

erator is the interaction of pressure pulses produced by unstable flow at the orifice and the resonance of the water column which is dependent on its height. As the water column falls, a series of tones are successively produced as the resonant frequency of the water column matches the frequency of pressure pulses generated at the orifice. The mechanism of the sound amplification in this set-up is identical to that in the pipe organ. In Savart's data the notes produced were expressed by musical notation and in some cases in terms of frequency in cycles per second, possibly as determined by comparison with the tone of Savart's wheel.

Two interlocking forces are concerned in the sound generation in the situation diagrammed in Figure 4: (i) what in the modern parlance would be referred to as vortex-shedding at the orifice (what Savart called fluid vein formation), and (ii) the resonance in the reservoir. The lower the level of water in the reservoir, in general the lower the frequency of the shedding of vortices at the orifice but the higher the natural frequency (shorter the wave length) of the resonator. It will be noted that a number of harmonics are generated at the orifice, the absolute frequency level of the harmonics depending on both the geometry of the orifice and the pressure-head, i.e., the height of fluid in the reservoir. The reservoir in turn picks out single harmonics which its own characteristics match and amplifies same. The result is a series of relatively pure tones interrupted by intervals of relative silence as the water level falls in the reservoir. The tones produced as the water level drops change in frequency and also each is less intense than its predecessor.[29a]

Savart[26v] formulated two laws of jet flow with respect to the length of the continuous "limpid" portion (i.e., the portion with streamline flow, as opposed to the region where the jet begins to break up): (i) for a given fluid and orifice the length was directly proportional to the square root of the height of the column which represented the pressure-head, (ii) for a constant head the length was directly proportional to the diameter of the orifice.

In the same paper of 1833[26v] Savart pointed out that if the container into which the jet is discharged is through its walls in physical continuity with the orifice plate which is creating the jet and therefore if the shock of the jet impact can be felt at the orifice plate, then the disintegration of the jet often assumes complete regularity and is attended by a musical note, even in the absence of the mechanism described above and pictured in Fig. 4B. Savart found that the frequency of the note so produced was directly proportional to the square root of the pressure-head and inversely

proportional to the area of the orifice. It seemed to be independent of the nature of the fluid; however, the variety of fluid investigated was not great. (See Fig. 4A for a sketch of the authors' conception of this model.)

In 1825[26a] and 1826[26b] in other experiments pertinent to cardiovascular sound, Savart studied the velocity of sound in fluid contained in elastic tubes. He found, as have others since that time, that the velocity is much less than that of sound in liquid in a free field. Lambossy[13b] indicates the significance of this observation. The problem was later studied,[13a] with similar results, by Sir Horace Lamb (1849-1934), a colleague of Osborne Reynolds at the University of Manchester where he was professor of pure, and later also applied, mathematics.

In 1819, the year that Laennec published his famous *Traité de l'auscultation médiate,* Savart arrived in Paris and published his *Mémoire sur la construction des instruments à cordes et à archet.* For the rest of his life Savart was in Paris during the exciting and often controversial period when the stethoscope was being widely used to describe previously unknown phenomena of cardiovascular and respiratory sound. Considering his medical background and the intense interest in medical varieties of sound created by Laennec's invention, it seems entirely credible that his physical experiments could have been motivated, and their character in part determined, by the phenomena being observed in patients. In the last ten years of his life the experiments with jets held his attention to the exclusion of almost all else. These studies could have been suggested by the anatomical conditions in stenosis of the heart valves (narrowing of valve orifices) as he may have seen it himself at the necropsy table or have read about it in the writings of Vieussens (1715), Morgagni (1769), Corvisart (1806), Laennec (1819), and others. (See Major's *Classic Descriptions of Disease* for republication, with illustrations, of these descriptions.) Unprepared to do physiological experiments in animals, he may have decided to investigate the same phenomena in physical models. It is true that no indication of medical motivation is given by Savart. On the other hand, no other indication of the origin of Savart's interest in the acoustic properties of jets is provided.

## Savart and the Experimental Method

It will be evident that Savart was an expert experimentalist. From his father he undoubtedly acquired an ability for ingenious design and expert execution of the mechanical aspects of experi-

ments. Lord Rayleigh and others in referring to his work repeatedly speak of his "beautiful experiments." Savart was a clever designer of model experiments. His use of Chladni figures has already been described. Furthermore, Savart used dyes—specifically indigo in a weak solution of sulfuric acid—for rendering visible the pattern of flow in jets. This was the method later used to advantage by Osborne Reynolds.[15a]

Finally, we would point out the advantages of Savart's practice of publishing all his reports in one journal, the venerable *Annales de chimie et de physique,* founded by Lavoisier and others in 1789. The advantages to the scientific worker are tremendous: One knows immediately where to look for a given publication; the journal becomes a scientific autobiography of the scientist. In these days of bibliographical deluge, this practice would be of significant help to workers in keeping up with what is euphemistically referred to as "the literature."

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# Vincenzo Chiarugi (1759-1820) and his Psychiatric Reform in Florence in the Late 18th Century

## (On the Occasion of the Bi-centenary of his Birth)

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AFTER the universal renown it enjoyed during the Renaissance, Florence slowly experienced during the eighteenth century a progressive decadence in the figurative arts as well as in literature. The tremendous impetus of a new civilization, which immortalized the city during the fifteenth and sixteenth centuries, was almost entirely exhausted. Nevertheless, destiny had reserved new glory for this favorite city, and a new tradition—a scientific one—was slowly grafting itself on the trunk of the humanistic tradition of the Renaissance.

The seventeenth century had largely broken with the classic tradition of the Renaissance to turn to the experimental method, initiating the modern scientific revolution. Following the way brilliantly opened by Galileo, a number of naturalists—from Torricelli to Redi and Magalotti—had greatly contributed to the progress of scientific knowledge, writing in a prose so clear and vivid as to assure for themselves a permanent place in the history of the Italian literature.[2] As an expression of this movement, the Accademia del Cimento, the first scientific academy of the world, was opened in 1657.

The beginning of the eighteenth century coincided with the manifestation of an open crisis which basically transformed society and ultimately contributed to its rebirth and to the creation of the modern world. While in England the liberal tradition inaugurated by Locke was continued by Hume, Adam Smith, and others, in France, Paris became the center from which the "light" of the most

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1 As has been frequently pointed out, there is not too much separation between scholars and scientists in the seventeenth and eighteenth cnturies. In Florence outstanding men of the time applied themselves with equal success to literature and sciences. For the names and the works of the most important of them, see: Rodolico, F., Ed., *La Toscana descritta dai naturalisti del Settecento,* Firenze, Sansoni, 1945.

2 On the scientific prose of the time: Falqui, E., Ed., *Antologia della prosa scientifica italiana del Seicento,* 2 vols., Firenze, Vallecchi, 1943. Giovannozzi, G., Il movimento scientifico in Toscana dal 1814 al 1859, in Bacci, O., Ed., *La Toscana alla fine del Granducato,* Firenze, Barbera, 1909, pp. 161-191.

brilliant minds of the time—from Fontenelle to Buffon, to D'Alembert, to Diderot, up to the greatest of all, Voltaire—shone on all Europe.

In Italy these same ideas of progress and of optimism found supporters, who, however, leaned more to the practical application than to the utopian aspect of the French ideology. Unfortunately, the influence of the supporters of these new ideas remained very limited, because of the particular political situation of that country.[3] Italy was in fact divided at that time in a number of small states, grossly influenced by the Augsburg dynasty in the north and by the Bourbon dynasty in the south.

Florence, contrary to other Italian states, had the advantage of being ruled by an enlightened man, the Grand Duke Peter Leopold (1747-1792). His father, Francis I (1708-1765), Duke of Lorraine, had become Duke of Tuscany in 1738, when this region was attached to the imperial crown. But he did not have the opportunity to remain in Florence, being elevated in Vienna to the imperial throne. For 26 years, from 1739 to 1765, Tuscany was ruled by a board of regents, composed of honest and capable local men, who prepared the ground for liberal and progressive reforms.

The times were ready again for Florence to contribute further to civilization, no longer with the wealth and the magnificence of the Renaissance, but rather with a deeper understanding of the basic issues of the new social reforms. Man, during the long labour of Enlightenment throughout the eighteenth century, had become aware of himself as an individual and as a social being and was determined to turn his scientific investigation to himself and to his own society.

Peter Leopold was the man who inaugurated this new period of splendor for Florence and its surroundings, a period which unfortunately has not received due attention from social historians of the eighteenth century, with the possible exception of a few scholars. Having become absolute ruler of Tuscany—in the so-called period of the "liberal absolutism"—at the age of 18, he pro-

[3] On the cultural importance of the Enlightenment: Cassirer, E., *Die Philosophie der Aufklärung*, Tübingen, Mohr, 1932 (Eng. trans., Princeton, Princeton Univ. Press, 1951); Hazard, P., *La crise de la conscience européenne*, Paris, Boivin, 1935; *id.*, *La pensée européenne au XVIII siècle*, 2 vols., Paris, Boivin, 1946; Havens, G. R., *The age of ideas*, New York, Holt, 1955; Mousnier, R., Labrousse, E., and Bouloiseau, M., *Le XVIII siècle*, Paris, Presses Univ. de France, 1955. On the Italian Enlightenment: Gentile G., *La filosofia italiana dal Genovesi al Galluppi*, Firenze, Sansoni, 1937; Capone Braga, G., *La filosofia francese e italiana del Settecento*, vol. II, part I, Padova, CEDAM, 1942; Sciacca, M.F., *La filosofia nell'età del Risorgimento*, Milano, Vallardi, 1947 (these three works contain an extensive bibliography). On medicine in the 18th century: Castiglioni, A., *A history of medicine*, New York, Knopf, 1947, Chap. 18; King, L. S., *The medical world of the eighteenth century*, Chicago, Univ. of Chicago Press, 1958.

gressively introduced a series of reforms which affected the most important areas of the nation's life—economic, financial, judicial, and educational.[4] A fervent admirer of the new ideas of progress developed in France, alone among the princes ruling Italian countries he permitted the publication of an Italian edition of the *"Encyclopédie"* in Lucca (1758) and in Livorno (1770). In the latter city two of the most important expressions of Italian Enlightenment, the work *Discorso della felicità* (Meditations on Happiness) by Pietro Verri and the work *Dei delitti e delle pene* (On Crime and Punishment) by Cesare Beccaria were published respectively in 1763 and 1764.

The value of the economic reforms has been emphasized by many, but scant notice has yet been given to the social reforms, especially insofar as they are pertinent to the achievement of a social conscience of individual freedom. The highest expression of all these aspirations was the detailed project of a political constitution, approved by the Grand Duke in 1778, which anticipated by many years the promulgation of the French constitution and which presented some similarities with the Virginia Bill of Rights of 1778.[5] This project, elaborated in an atmosphere of peace and cooperation by Peter Leopold and his collaborators[6]—thus quite

[4] On all these reforms, as well as on the history of Florence under the ruling of the Grand Duke Peter Leopold: Zobi, A., *Storia civile della Toscana dal 1773 al 1848,* Vol. II, Firenze, Molino, 1850; Tivaroni, C., *L'Italia prima della Rivoluzione francese,* Torino, Roux, 1880; Conti, G., *Firenze dopo i Medici,* Firenze, Bemporad, 1921; Anzilotti, A., Le riforme in Toscana nella seconda meta' del secolo XVIII, in *Movimenti e contrasti per l'unita' italiana,* Bari, Laterza, 1930; Brunello, B., *Il pensiero politico italiano del Settecento,* Milano, Principato, 1942; Mori, R., *Le riforme leopoldine nel pensiero degli economisti toscani del '700,* Firenze, Sansoni, 1951; Noether, P., *Seeds of Italian nationalism 1700-1815,* New York, Columbia Univ. Press, 1952; Quazza, G., *Il problema italiano alla vigilia delle riforme,* Roma, 1953-54; Levi Malvano, E., Pietro Leopold e la cultura italiana in Toscana, in *Il Sei-Settecento, libera cattedra di storia della Civilta' Fiorentina,* Firenze, Sansoni, 1956: Bedarida, H., Toscana e Francia nel Settecento, in *Ibid.;* Fubini, M., *Ed., La cultura illuministica in Italia,* Torino, Ed. Radio Italiana, 1957; Annoni, A., *L'Europa nel pensiero italiano del Settecento,* Milano, Marzorati, 1959. See also the two anthologies: Bulferetti, M., *L'assolutismo illuminato in Italia,* Milano, ISPI, 1944; Venturi, F., *Riformatori lombardi, piemontesi, toscani,* Milano-Napoli, Ricciardi, 1958.

[5] It is interesting to note that an attempt to establish commercial relations between Florence and the colony of Virginia was made around 1781 by an American, Filippo Mazzei, of Italian origin. This attempt, however, did not succeed and there is no evidence that the Grand Duke's political project was influenced by the constitution of Virginia. The similarities between the political constitutions of the two countries are only occasional, as shown by the comparison between the two made by J. Zimmermann, (*Das Verfassungsproject des Grossherzogs Peter Leopold von Toscana,* Heidelberg, Winter's Universitätsbuchhandlung, 1901). The same author states that Leopold's reform was much more radical than the one applied in Virginia.

[6] Leopold's concept of a political constitution was based on a great respect for the political rights of the citizens of his country and on a balanced harmony of power between the executive and the legislative bodies (see: Wolf, A., Ed., *Leopold II und Marie Christine. Ihr Briefwechsel 1781-1791,* Vienna, 1867. Docum. 58, pp. 80-82). Peter Leopold's excellent system of government is amply described in the book *Il governo della Toscana sotto il regno di Leopoldo II,* Firenze, 1790 (Germ. tran., Gotha, Perthes, 1795). In this work the financial statement regarding Leopold's court, which remained a unique example among the 18th century European courts, is also reported.

different from the similar constitutions which followed the horrors of the French revolution—unfortunately could not be put into effect because of the departure of the Duke for Vienna to become emperor in 1790. Furthermore, it was so radically new in its inspiration and so ahead of the times that it aroused more opposition than support even in those who would benefit from it.

As a part of Leopold's social and economic reforms, large extensions of land were reclaimed, vaccination for smallpox was introduced on an extensive scale, an institution for the rehabilitation of juvenile delinquents was founded, and torture and the death penalty were completely abolished. As far as medicine is concerned,[7] Peter Leopold was largely influenced by his brother Emperor Joseph II and by his court in Vienna where medicine had achieved a high reputation and prestige through the work of Van Swieten and Anton De Haen. In Tuscany this influence was combined with that of the medical schools of Pisa and Florence, which had already gained high reputations in the history of medicine. The University of Pisa, founded in 1343, could number among its teachers Falloppio, Vesalius, Mascagni, Malpighi, Bellini, Borelli, Cesalpino, and Cocchi. Florence, after the abolition of its "Studium Generale" in 1472, had developed science and medicine in a more empirical direction, especially in the big hospital of Santa Maria Novella.

It was to this hospital that Peter Leopold soon directed his attention in an attempt to introduce radical improvements in accordance with his program of social reforms. The problem of the care and treatment of the mentally ill, neglected and frequently brutally mistreated, came then to his attention in all its importance. In spite of the progress achieved in medicine and science, these people were still treated with primitive, inhuman methods, and the attitude of the public towards them was still characterized by a mixture of horror, terror, and hate.[8] Peter Leopold was not dismayed by these systems or discouraged by century-old prejudices. On 23 January 1774, the "legge sui pazzi" (law on the insane) was established, the first of its kind to be introduced in all Europe. On

[7] A chemist himself, Peter Leopold's desk used for his experiments is still preserved at the Museo di Storia delle Scienze in Florence. On medicine at the court of Peter Leopold: Filippi, A., La storia della scuola medico-chirurgica fiorentina, *Riv. St. Sci. Med. nat.*, 1923, *14*, 7-14, 86-90, 257-267; Castaldi, L., Storia della medicina in Toscana un secolo fa, *Ibid.*, 1937, *27*, 243-51; Corsini, A., *La medicina alla corte di Pietro Leopoldo, Riv. Ciba*, 1945, no. 46, 1510-1540.

[8] On these inhuman methods, as well as on the attitude of the public toward mental patients, see the interesting book by E. Kraepelin, *Hundert Jahre Psychiatrie*, Berlin, Springer, 1918.

the basis of this law, steps were taken to hospitalize individuals recognized as being insane. A few years later Peter Leopold undertook the project of building a new hospital for the mentally ill. In fact, the new Hospital of Bonifacio was begun in 1785 and a young physician, Vincenzo Chiarugi, was placed at its head. The succeeding events showed how fortunate the Grand Duke's choice had been, and most of the credit for the success of this important project goes to this first superintendent.[9]

Vincenzo Chiarugi, then 26, was born in Empoli, near Florence, in 1759. After graduating *summa cum laude* from the medical school of Pisa in 1780, he moved to Florence and did postgraduate work in the hospital of Santa Maria Novella. In 1788, three years after being placed in charge of the planning of the Hospital Bonifacio, the hospital was officially opened to take care of about 125 patients. The following year, in 1789, the *Regulations of the Hospital Bonifacio* were ready, and in 1793-1794 Chiarugi's main work, his three volumes "On Insanity" was published in Florence.[10] Following this, Chiarugi was appointed professor of dermatology and mental diseases in 1802, and later on, of physiology, pathology, and materia medica in the newly established medical school of Florence. In spite of the political changes which occurred there at the beginning of the nineteenth century, he continued his work of reform and of teaching until his death in 1820.

It is impossible, considering the limited scope of this historical presentation, to examine in detail Chiarugi's contribution to

[9] According to the historian A. Zobi (*op. cit.*, p. 8), Peter Leopold, though not particularly intelligent, had a great skill in selecting his collaborators and in translating into practice the new ideas of social philosophy of the Enlightenment.

[10] The full title of the book is: *Della pazzia in genere e in specie trattato medico analitico con una centuria di osservazioni*, Firenze, Carlieri, 1793-1794, 3 vols. A second edition, incomplete, was published by Pagani in Florence in 1808. A condensed German translation of the first edition appeared under the title: *Abhandlung über den Wahnsinn überhaupt und insbesondere nebst einer Zenturie von Beobachtungen*, Leipzig, 1795. Only two copies of the original Italian first edition are known in this country, one at the National Library in Cleveland and the other at the Yale Medical Library.

Among other works by Chiarugi worth noting are: *Saggio teoricopratico sulle malattie cutanee sordide osservate nel R. Spedale Bonifacio di Firenze*, Firenze, Allegrini, 1799; 2nd. ed., Firenze, Pagani, 1807; *La fisica dell'uomo, ossia corso completo di medicina ad uso degli ufficiali di sanita'*, Firenze, 1811-12, 2 vols.

Chiarugi occupied himself also with questions concerning agriculture, as shown by his essay "Osservazioni georgiche sulla cultura delle adiacenze di Firenze lungo la strada regia bolognese," presented to the "Accademia dei Georgofili" in 1798, and published in its *Atti*, 1804, *5*, 242-249. It has been recently republished in F. Rodolico, Ed., *op. cit.*, pp. 127-129.

Chiarugi also wrote a history of his own home town, under the title *Della Storia d'Empoli*, which remained unedited until very recently .It was published on the occasion of Chiarugi's bi-centenary, in *Bollettino Storico Empolese*, 1959, *3*, 321-390.

psychiatry.[11] Only the main theme running through his psychiatric works, namely, the principles of treatment of the mentally ill, can be mentioned here. To be sure, around the same time some progressive Frenchmen like Jean Colombier and Jacques-Réné Tenon had expressed the need for a different approach toward mental patients.[12] However, their voices were not heard for several years, so to Chiarugi goes the credit of having first applied in practice the principles previously described theoretically.

What are these principles? Obviously, Chiarugi was the son of his time, as revealed especially by many passages of his treatise concerning the psychological foundations of the individual and the psychopathological principles underlying the classification of mental disorders. Chiarugi accepts the concept that perception is a state induced by the action of external objects on the "sensorium commune," but it also requires the active functioning of the soul. Soul, on the other side, is the determining agent of movement and thought, but it needs for its functioning either the material offered by the perception of external objects or by the fantasy (formed by traces of previous perceptions). The "sensorium commune" (which is the highest level of operation of the nervous system) is the mediating organ between senses and soul, in that it is influenced by the senses on one side and by the soul on the other. Every idea experienced by the soul is accompanied by a sense of good or bad, of pleasure or displeasure, which constitutes the emotions. The effects brought about by these emotions are known as passions or affections of the soul, and—manifesting themselves through facial expressions and other appearances of the body—are of primary importance for the recognition of mental diseases. In other words, while at an organic level the "sensorium commune" is the mediating agent between senses and intellect, at a psychological level passions are the mediating agent between body and soul.

In summary, Chiarugi's concept of man as attempting to establish a "trait d'union" between body and soul constantly fluctuates between the Aristotelian-tomistic and Cartesian views, without disregarding Platonic influences. ("The soul, without doubt spiritual, is incapable of changes within itself, is unalterable in substance

[11] For a more detailed examination of Chiarugi's contribution to psychiatry: Padovani, E., Pinel e il rinnovamento dell'assistenza agli alienati. I suoi precursori. I predecessori italiani: Giuseppe Daquin e Vincenzo Chiarugi, *G. Psichiat. Neuropat.*, 1927, 55, 69-124; Mora, G., Vincenzo Chiarugi (1759-1820). His contribution to psychiatry, *Bull. Isaac Ray med. Libr.*, 1954, 2, 50-104. Both these articles contain an important bibliography.

[12] On Jean Colombier (1785) and Jacques-Réné Tenon (1788), see G. Zilboorg, *A history of medical psychology*, New York, Norton, 1941.

and cannot be affected by those conditions which affect matter and which constitute disease.") Similarly, the essence of insanity, based on an "impairment of the physical structure of the brain" (thus clearly influenced by Morgagni's teaching of pathology) is at other times considered as due to purely psychological events ("between passions and insanity there is only a difference of degree and duration"). Chiarugi, as well as other contemporary authors on psychological matters, offers definite evidence of belonging to a transitional era: i.e., desire to break with the metaphysical tradition on one side and difficulty in accepting in psychology (as in physics and in the natural sciences in general) a strictly scientific viewpoint on the other. Fortunately, such an uncertainty of viewpoints is limited to the general psychological issues, while the discussion of clinical matters reveals a full acceptance of the experimental method.[13]

Closely following William Cullen's ideas, Chiarugi postulates a division of insanity in three main categories: melancholia, mania, and amentia. Melancholia (true, false, or violent) is characterized by "fixation of the mind on one or few distorted ideas, while the other intellectual functions remain untouched." Mania is "a generalized insanity accompanied by violent and impetuous actions." Dementia (congenital or acquired) "is general insanity characterized by abnormal actions of both the intellect and the will, performed without any show of emotions."

As causes of insanity, congenital and acquired factors are considered and among the latter, environmental forces are predominant because "through education a man's character is molded, his senses develop, and even his inclinations may be modified."

In describing the diagnostic principles, Chiarugi emphasized the importance of considering "the external signs and the general phenomena which accompany insanity," and the frequency of a cyclic pattern in the course of many psychiatric conditions. His discussion of prognosis also reveals his insight, in that he states that conditions due to acute or physical causes have a better outcome than long-term ones, especially if these latter are combined with defective education.

All these points made by Chiarugi in his book, although an expression of contemporary views, are worth noting for their sober-

[13] On all these questions, beside the histories of psychology, one can consult the following three important studies: Soury, J., *Le système nerveux central. Structure et fonctions. Histoire critique des théories et des doctrines*, Paris, Carré, 1899, especially vol. I; Révész, B., *Geschichte des Seelensbegriffes und der Seelenlokalisation*, Stuttgart, Enke, 1917; Riese, W., *A history of neurology*, New York, M D Publications, 1959 (especially Chapt. IV, The history of the doctrine of cerebral localizations).

ness and clarity, in contrast to the obscurities and meaningless classifications frequently found in other writers. They are, however, collateral to Chiarugi's main contribution to psychiatry, his reform of the treatment of mental patients. As the description of his principles of treatment is scattered through his "Regulations" and through his book "On Insanity," a considerable work of reordination and reorganization of the material has to be done in order to arrive at a grasp of his therapeutic philosophy. Only after doing this is one able to evaluate the significance of Chiarugi's reform. A detailed history was required for each patient admitted to the hospital. The hospital was built to meet high hygienic standards, men were separated from women, and the rooms and furniture offered full protection to the patients. However, under no circumstances could force be used on patients, and the only methods of restrictions allowed were strait jackets and strips of reinforced cotton, in order to prevent impairment in the patient's blood circulation. The essence of Chiarugi's reform lies, however, in the direct treatment of the patients, for which nothing is better than to quote him directly. "It is a supreme moral duty and medical obligation to respect the insane individual as a person." "It is especially necessary for the person who treats the mental patient to gain his confidence and trust. It is best, therefore, to be tactful and understanding and to try to lead the patient to the truth and to instill reason into him little by little, in a kind way." And later on: "The attitude of nurses and doctors must be authoritative and impressive, but at the same time pleasant and adapted to the impaired mind of the patient." "Generally it is better to follow the patient's inclinations and give him as many comforts as is advisable from a medical and practical standpoint." "It is absolutely forbidden to make patients work for the hospital, except by a special prescription of the physician, in cases where certain activities are indicated as a form of therapy or relief."

In considering Chiarugi's reform now from an historical perspective, there is no question that it constitutes the first application of the principles of psychiatric treatment which are at the basis of psychiatry even today. There is no evidence in the history of psychiatry of any other reform of similar type prior to that by Chiarugi. It is important to stress that such a reform involved not only the organization of a new hospital and new facilities, but the cooperation and dedication of a large staff, and—even more important than this—the overcoming of all kinds of prejudices and misunderstandings concerning the mentally ill. This gives an indication of the

depth and significance of Chiarugi's reform.[14] Being a modest man, Chiarugi seemed almost unaware himself of the importance of his work. In his three-volume book there is no reference to the novelty of his conception. Nothing is more striking, for the medical historian, than to compare Chiarugi's treatise to Pinel's *Traité médico philosophique sur la manie* which appeared in 1801. Certainly Pinel's book is impressive for its clarity of concepts and style, so characteristic of French scientific literature. But in their essential lines, in the presentation of the principles of the classification, etiology, diagnosis, prognosis, and treatment of mental diseases, there is almost no difference between the two works. Instead, the difference, and very marked it is, lies between the above-mentioned unassuming attitude of Chiarugi and the emphatic, dramatized attitude of Pinel.[15] The short and harsh judgment that Pinel passed on Chiarugi's work[16] has unfortunately been accepted by many historians and psychiatrists in spite of its lack of critical validity.

Such a judgment, however, cannot alone account for the oblivion that Chiarugi's work underwent throughout the nineteenth century. Several factors must have contributed to this situation, such as the difficulty of finding his book, and then of reading the text in a little-known language, also the long-continued interference with scientific progress caused by the wars of independence in nineteenth century Italy. Perhaps even more important than this must have been the fact that unlike William Tuke's work in England and Pinel's work in France, both initiating an illustrious tradition of psychiatry, Chiarugi's influence ceased at his death because of lack of a successor. The fact remains that there is little mention

[14] To complete the picture of Chiarugi's reform it would be important to have statistical figures regarding the movement of patients in the Hospital Bonifacio, such as admissions, types of diseases, improvements, discharges, and so on. Unfortunately, as is the case with many other hospitals of the time, such figures are not available today.

[15] Such a tendency was further reinforced by Pinel's admirers and perhaps found its highest expression in the famous painting by T. R. Fleury, displayed in the Salon of Paris in 1879. Such a painting representing Pinel giving the order to break the chains from a young woman has been frequently reproduced. In considering another pictorial representation of a mental hospital, "La casa de locos" (The Madhouse) by F Goya (1746-1828), one is impressed by the psychological insight and the realism of this latter, in contrast with the dramatic artfulness of the other one. (On Goya's painting, see: J. W., From Madhouse to Mental Hospital, in Impressions from the 115th Annual Meeting of the American Psychiatric Association, Philadelphia, April 27-May 1, 1959, *Documenta Geigy*, Geigy Farmaceuticals, Ardsley, N. Y.).

[16] Pinel wrote in fact: "It was Chiarugi's lot to follow the beaten track, to speak of madness in general in a dogmatic tone, then to consider madness in particular, and to return again to the old scholastic order of causes, diagnosis, prognosis and symptoms to be followed. The spirit of research hardly shows in his work; it is more evident in the one hundred observations which he published, although even these offer little material for conclusive implications." (Pinel, P., *A treatise on insanity*, Eng. tran., Sheffield, England, 1806, Introduction.)

of Chiarugi's reform in the medico-historical and psychiatric literature of the nineteenth century with the exception of a famous polemic of Carlo Livi in 1864.[17] Even distinguished medical historians such as Salvatore DeRenzi and Francesco Puccinotti, well versed in Italian scientific developments, overlooked Chiarugi's reform entirely. As mentioned in a recent article,[18] Chiarugi's name was remembered only incidentally in some textbooks of psychiatry or publications of little importance. It was necessary to wait until the beginning of this century for a slow evaluation of Chiarugi's work. Such an evaluation, initiated by the brief presentation of S. Kornfeld and the beautiful essay by Alberto Vedrani,[19] is still in process today. It has therefore appeared that a commemoration of Chiarugi's birth could contribute to this process of historical clarification and re-evaluation of a man whose work constitutes a major landmark in the history of psychiatry.

17 The Italian psychiatrist Carlo Livi published an open letter *Pinelo o Chiarugi? Lettera a Brierre de Boismont* in the newspaper *La Nazione* of Florence in 1864. This letter was republished several times in the Italian psychiatric literature, and more recently by C. Ferrio, *La psiche e i nervi, Introduzione storica ad ogni studio di psicologia, neurologia e psichiatria,* Torino, Un. Tip. Editr. Torin., 1948, 306-318.

18 E. Padovani, Fortune e sfortune di Vincenzo Chiarugi, *Note Psichiat.,* 1957, *50,* n.s.

19 S. Kornfeld, Geschichte der Psychiatrie, in Th. Puschmann's *Handbuch der Geschichte der Medizin,* Jena, Fischer, 1905, vol. III, p. 639; Vedrani, A., V. Chiarugi, in Mieli, A., Ed., *Gli scienziati italiani dall'inizio del medio evo ai nostri giorni,* Roma, 1923, vol. I, 40-44. Among the other studies dedicated to Chiarugi, see: Zalla, M., Vincenzo Chiarugi, *Sperimentale,* 1924, *78,* 327-332; Capparoni, P., Vincenzo Chiarugi, in *Profili biobibliografici di medici e naturalisti celebri italiani,* Milano, Ist. Naz. Farmacol. Serono, 1928, II, 123-125; Medea, E., Vincenzo Chiarugi e l'assistenza psichiatrica in Italia, *Rendiconti del Reale Istituto Lombardo di Scienze e Lettere,* 1939-40, *73,* 492-496; Ferrio, C., *op. cit.,* pp. 304-306.

# Camille Picqué's *Adolphe Occo III. Le Médecin Numismate d'Ausbourg et sa Médaille au Squelette Vesalien**

CHARLES DONALD O'MALLEY**

IT may perhaps appear odd that attention is presently called to a paper published sixty years ago. The fact is, however, that this particular paper, hitherto unrecorded in the Vesalian bibliography and recently acquired by the Historical Library of the Yale University School of Medicine, contains information of interest relative to Adolph Occo III, Augsburg physician, friend and colleague of Vesalius, and therewith contributes briefly but interestingly to our knowledge of Vesalius' relations with the medical profession of Augsburg. Moreover, M. Picqué, once Conservateur at the Bibliothèque Royale de Belgique, was not an historian of medicine and appears not to have been fully aware of this aspect of his information.

We are informed by M. Picqué of a silver medal of Adolph Occo III, struck in 1552 when Occo was twenty-eight years old. The medal, which M. Picqué hazards to have been the work of Cornelis Floris (1514-1570), is 55 mm. in diameter and bears on its obverse a bust in profile of Occo wearing his physician's bonnet and the legend ADOLPHUS OCCO. A. F. AVGVST. MED. MED. ANNO AETAT XXVIII. The reverse of the medal displays a skeleton very much in the pose of, and obviously strongly influenced by, the skeleton in lateral view in the *Fabrica*. The monument, on which it rests one elbow while the other forearm and hand are supported by an hour-glass — in the *Fabrica* a skull — carries the legend ABSORPTA EST MORS IN VICTORIAM, which may be translated as "Death has been transmuted into victory." One is naturally reminded of the consolation expressed in the phrase VIVITUR INGENIO CAETERA MORTIS ERUNT which accompanies the skeleton in the *Fabrica*. Circling the scene is a somewhat more lugubrious reminder IPSE IVBET MORTIS TE MEMINISSE DEVS, "Your God orders you to remember death." The remainder of the paper makes mention of other medals and portraits of Occo, as well as of his father

* Extrait de la *Revue belge de numismatique*, année 1899. Bruxelles, 1899. 2, 34 pp., 4 illus.

** Los Angeles, California.

and grandfather, but these are of secondary importance and have no special Vesalian, or indeed medical, significance. There is a reproduction of the medal of 1552, of the skeleton from the *Fabrica,* and of two later portraits of Occo taken from literary sources.

M. Picqué contends, as recent investigation has amply proved, that depictions of skeletons earlier than those of the *Fabrica* were clumsy things at best and most frequently employed to call attention to the depressing fact of man's mortality, if not his all too frequent ultimate fate. The depiction of the skeleton in the *Fabrica,* as well as its legend, marked a break in this tradition and was the prototype of a new presentation. Occo's medal, writes M. Picqué, is an example of this new Vesalian influence. However, it is possible for one to demonstrate that while the *Fabrica* provided the model of the skeleton for this medal, a still closer tie between Vesalius and the family Occo must have made the latter even more conscious of the great anatomist's work and so called further attention, if that was necessary, to the novelty of the illustrations of the *Fabrica.*

Vesalius' ties with Augsburg began during his Paduan days. In the *Fabrica* (I, viii, p. 35) he remarks that he was "supremely devoted to" Wolfgang Herwart, whom he calls a "patrician of Augsburg," because "he did everything possible to aid the completion of this work." It cannot be said precisely what this Wolfgang Peter Herwart contributed, although it is not entirely beyond the bounds of reason that as a member of a wealthy banking family he may have been able to provide something in the way of a subsidy for the very costly preparation of the *Fabrica.* Nor do we know what Herwart was doing in Padua, although it is not improbable that he was studying law at the university. We are also ignorant of what drew the two young men, of the same age, together—it may have been their common imperial citizenry or it may have been the result of Vesalius' professional care. The first Vesalian *consilium* of which we have record is one dated Padua, 29 April 1542, addressed to Herwart on behalf of a young man "about twenty-seven years old" whose vision had been destroyed in one eye and weakened in the other. The age mentioned naturally suggests that the patient was Herwart who, as we do know, became completely blind in 1553. So far as we are aware, this relationship represents Vesalius' first contact with any citizen of Augsburg.

Whether or not Vesalius maintained an epistolary relationship with Herwart after he left Padua we do not know, but at any rate

the friends were to meet once again in 1547. In that year Vesalius was in Augsburg with the emperor and the imperial forces engaged in the Schmalkalden war and took advantage of the sojourn to renew acquaintance with his old friend through whom, quite possibly, he was brought into close touch and ultimately friendship with certain members of the medical profession. Herwart as a leading citizen and member of the city council would naturally be acquainted with the chief physicians of the city, and, indeed, we find that some years later he was delegated as one of a committee otherwise composed of Adolph Occo III, Achilles Gasser, and Lucas Stenglin, physicians and friends-to-be of Vesalius, for inspection of the pharmacies of Augsburg. At any rate, it was in 1547 that Vesalius became acquainted with the Occos, Adolph II and Adolph III.[1]

After his initial acquaintance with these physicians, Vesalius had an opportunity to renew that acquaintance when in 1550 he was again in Augsburg with the emperor and remained there until 2 November 1551. On this occasion there was neither military activity nor plague, such as had accompanied his previous visit, and as a result he was able to observe some of the more interesting medical cases and to participate in the autopsy examinations carried out on such of them as had fatal terminations. Mention of a number of these autopsy examinations is made in the revised edition of the *Fabrica* published in 1555, where we find a description of a woman of fifty who had suffered for the space of a year from a swollen abdomen (V, ix, *Opera omnia,* I, p. 438).

> In Augsburg I, together with several physicians, discovered more than sixty Augsburg measures of serous water in the uterus of a deceased female weaver; the uterus alone weighed three pounds. However, there was no water around the intestines or a loose humor in the hands, feet, or even in the viscera, nor was there damage of any other organs. In addition, that great uterus, of which the mouth of its fundus had thickened remarkably, was in the whole anterior part attached to the peritoneum. The glands of the right ovary had increased astonishingly, as if nine or ten goose eggs, or rather an ostrich egg were therein, and they were filled with a humor like white of egg or a little thicker.

A second case was that of the distinguished and learned Herr von Imersel. Vesalius participated in the autopsy examination which

[1] Adolph Occo II, 1494-1572, of Brixen in the Tyrol, was the son of Adolph I, physician to Sigismund, Archduke of Austria. Adolph II studied and became M.D., at Bologna in 1519. Establishing himself in Augsburg, he became physician to the City hospital. Adolph III, 1524-1606, of Augsburg, received his M.D. degree at Ferrara in 1549, whence he returned to assist and then to succeed his father. He was ennobled by Maximilian II in 1573.

Fig. 1. Reverse of silver medal of Adolph Occo III.

made sufficient impression on him so that he refers to it twice, the first time in the revised *Fabrica* (I, v, *Opera omnia,* I, p. 17).

> About the same time we were greatly astonished by the heart of a noble and learned man, in the left ventricle of which we found almost two pounds of glandulous—but blackish—flesh, the heart in the shape of a uterus and extended by the mass of the flesh like the brain of that girl [to be mentioned below]. Before death this man was of a somewhat melancholy temperament, very wakeful and possessed of a remarkably uneven and varying pulse which clearly indicated the contraction of the artery. Thus for many months before his death—although he walked about as if, on the contrary, healthy—the pulse, or rather the artery, seemed to contract so that it remained contracted for an interval of three or four pulses or beats, as if it were attempting expulsion. Indeed, in the final weeks of his life three or even two dilatations of the artery occurred to the touch within a normal interval of nine beats. The animal faculty, with the functions of the animal spirits, remained until his death which occurred not so much from any defect of the heart as from gangrene of the left leg, which arose from the impeded pulse of the artery as if those pulses, interrupted through defect of the heart, did not sufficiently revive the native heat of that leg; especially since several years earlier an artery which extends to the lower leg had been damaged by a gunshot wound.

In his *Examen (Opera omnia,* II, p. 284) Vesalius remarks of the case that "Several physicians of Augsburg . . . had been called to the noble and learned Lord of Imersel while he was still living, at first because of a gangrenous affection of his leg, and so I also was present for consideration of his heart." A second, closely related, case was that of a servant of Herr von Mol (*Examen, Opera omnia,* II, 824): "Also in the same year and likewise because of gangrene, the heart of a servant of the Lord of Mol was observed. First we had amputated his leg below the knee, then several days before his death, and even though our hopes were slight, his hand about the middle of his forearm."

A final observation was that made upon a little girl of two years who had developed such a large collection of fluid in her head that within the course of seven months it had grown to far greater size than that of a man (*Fabrica,* 1555, I, v; *Opera omnia,* I, pp. 16-17):

> In Augsburg I observed a little girl of two years whose head had so enlarged in about seven months, that it surpassed the size of any man's head which I have ever seen. It was that ailment which the ancients called hydrocephaly, in which water is gradually collected and retained in the head. However, in this girl it had not collected between the skull and its exterior girdling membrane or the skin—where the books of physicians otherwise teach that the water is retained—but in the cavity of the brain itself, in its right and left ventricles. Their capacity and cavity had so increased and the brain itself had been so extended that they contained

almost nine pounds of water or, incredible as it may seem, three Augsburg measures of wine. In addition, as the brain in the vertex of the head was thin like membrane, or like a body continuous with its thin membrane, so also the skull was wholly membranous and osseous only in that area representing the girl's skull before her head had abnormally increased, almost as we observe the frontal bone and bones of the vertex to form in recently born children where they, otherwise coterminous, in many children are observed to be membranous for a notable interval and space. Meanwhile the cerebellum and the whole base of the brain were normal as well as the extension of the nerves. Furthermore, I found water in no other regions except in the ventricles of the brain which were augmented as I have mentioned, and up to the time of her death the girl wholly enjoyed all her senses. When I observed her a few days before her death, as often as her head was moved by those in attendance, and however slightly it was raised, immediately she was disturbed by a severe cough, with difficulty in breathing, suffusion of blood and flushing of the whole face, and flowing of tears. The rest of her body was weak, but although lax and infirm there was no paralysis of the limbs nor even any notable appearance of emaciation or serous swelling in the limbs, or epilepsy. When the liver was examined shortly after death, it was found to be pale, somewhat more contracted and harder than a normal liver; the spleen appeared very large and soft as if it had functioned for some time in place of the liver; so that I, like the physicians present, was much astonished that such a supply of water had for so long collected in the ventricles of the brain without more pronounced symptoms.

Vesalius appears both to have esteemed and to have been esteemed by his Augsburg friends, and while it may be true that the skeleton of the *Fabrica* would under other conditions have influenced the design of Occo's medal, the choice was certainly not impeded by the friendship which had developed and of which we have further records until Vesalius took service with Philip II and removed to Spain. The first of these is a *consilium*, dated Brussels, 6 November 1553, regarding an Augsburg patrician, Marcus Pfister, father-in-law of Vesalius' old friend Wolfgang Herwart. Pfister, an old man who died in 1561, suffered from a skin irritation for which Vesalius prescribed some of the standard remedies of the day. It is not a *consilium* of particular importance and was not a case which should have had any special interest for Vesalius. His advice most likely represents a favor to friend or colleague. About 1555 Vesalius was called to Augsburg for the case of another patrician of that city, Leonard Welser, member of the famous banking family of that name, who was attended by Achilles Gasser and Adolph Occo III. No doubt friendship determined their choice of consultant. Upon investigation Vesalius discovered a pulsating tumor in the back of the patient which he immediately declared to be a fatal aneurysm of the aorta. After

more than two years' suffering the patient resorted to a quack with no result except the inevitable death. An autopsy performed on 25 June 1557, by both Occos, Ambrose Jung, and Lucas Stenglin bore out the diagnosis made by Vesalius to whom a report was sent by Achilles Gasser. Vesalius replied to this from Brussels, the last record we possess of his affiliation with the medical profession of Augsburg, one which in every aspect appears to have been unusually pleasant and amicable.

# John Morgan's Outlines of a General History of Physic (1765)

## Medical History in 18th Century Academic Medical Teaching

FRED B. ROGERS*

SURVIVING examples of the earliest lectures in the first two medical schools in the British North American colonies are rare. We know, however, that a brief account of the general history of medicine customarily served as an introduction to the courses of the pioneer faculty members of the College of Philadelphia and King's College in New York City during the first decade of their existence. Except for such introductory lectures, generally preserved only in students' notebooks, we know relatively little of what medical professors said and taught on the history of their profession and specialties.

A student notebook of Jonathan Elmer (1745-1817), member of the first graduating class at the Medical College of Philadelphia, contains an interesting outline of the history of medicine presented in 1765 by his teacher Dr. John Morgan (1735-1789) whose apprentice he also was. Born in Bridgeton, New Jersey, Jonathan Elmer was graduated Bachelor of Medicine in the first class (1768) at what is now the University of Pennsylvania School of Medicine. Three years later he received the degree of doctor of medicine,[1] dedicating his thesis to Benjamin Franklin who, pleased by this "performance," expressed his gratitude in a letter from London and wished the "young gentleman . . . the success His Integrity seems to promise him."[2]

Jonathan Elmer deserved Franklin's—and Morgan's—approbation. He became an eminent practitioner in his home state, and was elected fourteenth president of The Medical Society of New Jersey in 1787. His friend Benjamin Rush once said of him that in professional ability "he was exceeded by no physician in the United States." Turning to politics at the outbreak of the Revolution,

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[1] In 1958 Jonathan Elmer's M.D. diploma was presented to the University of Pennsylvania by his great-great grandson, Dr. Walter G. Elmer of Philadelphia.

[2] Benjamin Franklin to Dr. Thomas Bond, London, Feb. 5, 1772. Letter quoted by William Pepper, in "The medical side of Benjamin Franklin." *Univ. Penn. med. Bull.*, 1910, *23*, 56.

Elmer had an equally distinguished public career as a member of the Continental Congress and judge of the Cumberland County Courts. He was a member of the American Philosophical Society.

The following *Outlines,* in a small quarto volume of manuscripts labelled *Miscellanies,* precedes clinical notes taken by Jonathan Elmer at Dr. Morgan's lectures on medicine in Philadelphia during the autumn of 1765. Concise and comprehensive, his lecture covers the development of medicine from ancient times to the first half of the eighteenth century.

## Outlines of a General History of Physic

In tracing the Outlines of the History of Physic or medicine we shall take notice:

1. Of the State of Physic from the earliest ages to the time of Hippocrates
2. Of the State of Physic after Hippocrates amongst the Greeks & Romans
3. Of the State of Physic amongst the Arabians
4. Of the State of Physic from the revivals of Learning to the time of Dr. Harvey
5. From the time of Dr. Harvey to the present time.

Apollo & Aesculapius said to be inventors of Physic. Aesculapius lived about 700 years before Hippocrates—Podalirius & Machaon his sons were physicians at the siege of Troy.

The Egyptians & Chaldeans appear to have had some knowledge of Physic, especially the Egyptians. Mercurius, Serapion, Herophilus & Erasistratus were Egyptian physicians.

Pythagorus, Empedocles, Heraclitus, Democritus & others, were Greek physicians before Hippocrates. Thessalos-Tralles, Praxagorus & Aretaeus after him.

Hippocrates is stiled the Father of Physic—is the first whose writings have been handed down to us—he was born A.M. 3572, about 450 before Christ—inclined to the Pythagorean philosophy of odd numbers. Some account of his writings & Commentators upon him.* The Copernican philosophy & physic amongst the ancient Greeks occasioned different sects of physicians amongst the Greeks & Latins.†

*Aretaeus Cappadox* the best writer next to Hippocrates. *Aristotle* the author of the Peripatetic Philosophy was born 384 years before Christ.

Themison, Soranus, *Celsus,* Musa, Dioscorides, *Galen* & Caelius Aurelianus were Latin physicians. *Celsus* the best—called the Latin Hippocrates—lived in the reign of Augustus & was a good writer.

*Galen* was born A.D. 131. His theory of physic is founded on the Peripatetic Philosophy, was a great physician & voluminous writer.

* Commentators—Galen, Haller. Valerius, Lucretius, De Gorter.
† Empyric, Dogmatic, Methodic, Pneumatic, Episynthetic, Eclectic.

Oribasius, Aetius, Paulus Aegineta & Thales were modern Greeks.

About the 3d & 4th centuries learning cultivated chiefly in the Eastern Empire & Egypt. The Ptolemies in Egypt great encouragers of Learning—and Alexandria became famous for the study of physic. This City was taken by Saracens in 640 & the Greek physic was thereby introduced among the Arabians. These people extending their conquest in Asia & Africa at length got footing in Spain & Italy by war means. The Arabian physic was introduced into Europe — Rhasis, Haly Abbas, Avicenna, Avenzoar & Averrhoes Arabian physicians.

In 802 a Physical College was founded at Salernum & afterwards other medical schools, in all of which the Arabian physic was chiefly taught, until the taking of Constantinople by the Turks in 1452, when many learned Greeks retiring into Italy, carried the original Greek copies with them, which were afterwards studied in Europe instead of the Arabian translations & Commentaries.

The art of printing being introduced about the year 1466, learning which from the destruction of the Roman Empire had declined in Europe began to revive. Physic began to improve—Linacre, Caius, Vesalius, Eustachius, Fallopius, Malpighi, Bartolini, Prosper Alpinus, Lewenhoeck, before Harvey. Paracelsus & Van Helmont authors of whimsical theories in physic—Wepfer & Stahl in some measure their successors.

Dr. Harvey discovered the Circulation of the Blood & Sanctorius insensible perspiration which introduced a new Era in physic. 1628

Physicians & improvements in physic since the discovery of the Circulation.

The Reformation in religion begun by *Luther* and in philosophy by *Lord Bacon* paved the way for improving every branch of science & amongst the sect physic.

The Peripatetic Philosophy prevailed near 1000 years to the time of Lord Bacon—until the time of Paracelsus & Van Helmont the Doctrines of Galen mostly adopted in physic. The chemical theory introduced by these men & soon after the Cartesian Philosophy by Descartes which prevailed some time.

With the *new* Philosophy the *mechanical* Theory of physic was introduced to which have now succeeded the *spasmodic* system of Dr. Cullen & the *asthenic* system of Dr. Brown.

Boerhaave's the first complete System of Physic ever published—about 1728. Dr. Boerhaave's Academical Lectures on the Medical Institutes or Theory of Physic with Dr. Haller's notes in the English translations is in 6 vol: 8 vo. On the practice of physic his *Aphorisms* concerning the knowledge & cure of diseases, with Van Swieten's Commentaries in 18 vols: 8 vo.

Dr. Haller has greatly improved physiology since Boerhaave's time. He was the first who clearly demonstrated the difference between *irritability* and *sensibility*. That irritability resides in the muscular fibers & sensibility

in the nerves. He likewise supposes there is a *vis insista* in the muscular fibers distinct from the *vis nervea;* but this is doubted by some. His physiological works are 1st Primae Lineae Physiologiae in 1 vol. To some late editions of it there are notes by Dr. Wrisberg—2d Elementa Physiologiae in 8 vols: 4 vo. This has not been translated into English.

That such an account of the general history of "physic" was customary in medical teaching during the eighteenth century becomes apparent upon perusing standard texts from that period. In the year after the above *Outlines* by Dr. Morgan was recorded, for example, the first part of *Dr. Boerhaave's Academical Lectures on the Theory of Physic* (third English edition)[3] included 51 pages on "the History of Physic." Arbitrary temporal subdivisions in this chronology were: first rise of physic; progress of physic before Hippocrates;—under Hippocrates;—under Galen;—from Galen to Harvey;—after Harvey.

Also, in a notebook of one Dr. Rhodes in the Historical Collections at the College of Physicians of Philadelphia,[4] outlining *Clinical Lectures* by Dr. William Cullen at Edinburgh in 1770, the first four lectures pertain to "the history of physic." Six medical epochs appear in these notes: 1. Ante Christian; 2. to 287 A.D., when Serapion lived at Alexandria; 3. to Augustus Caesar, when Themison flourished; 4. to A.D. 150, when Galen lived; 5. from Galen to near the beginning of the 17th century, "when Harvey's discoveries were cordially received"; and, 6. from the middle of the last century to the present time (1650-1770). Dr. John Gregory (1724-1773), a contemporary of Cullen at Edinburgh, in his *Observations on the Duties and Offices of a Physician* (1770), also cited the obvious advantages to the physician in a broad knowledge of the past.[5]

In similar fashion, Boerhaave's *Elementa Chemiae,* first published in 1731 and subsequently reissued in several translations, begins with a detailed history—and bibliography—of chemical knowledge of that age. Almost sixty pages are devoted to this purpose in the third English edition of the work, translated by Dr. Peter Shaw of London in 1753.[6]

[3] *Dr. Boerhaave's academical lectures on the theory of physic. Being a genuine translation of his Institutes and explanatory comment, collated and adjusted to each other, as they were dictated to his students at the University of Leyden.* 3d ed. London, J. Rivington, 1766, vol. 1.

[4] Cullen, William. Clinical lectures. Edinburgh, 1770, 3 vols. (Manuscript notes by Dr. Rhodes. College of Physicians of Philadelphia.)

[5] Gregory, John. *Observations on the duties and qualifications of a physician, and on the method of presenting enquiries in philosophy.* London, W. Strahan & T. Cadell, 1770.

[6] Shaw, Peter, Ed. *A new method of chemistry; including the history, theory, and practice of the art:* translated from the original Latin of Dr. Boerhaave's *Elementa chemiae,* as published by himself. 3d ed. London, T. & T. Longman, 1753, vol. 1.

In his lectures on chemistry, delivered early in 1766, Dr. John Morgan also devoted the first part of his course to an historical review of this science. Another student notebook, that of John Hodge, who received his M.B. degree in 1769, is preserved in the Library of the College of Physicians of Philadelphia.[7] The first 38 pages of manuscript notes in this quarto volume comprise a thorough historical review of the development of chemistry from earliest times, with footnotes and pertinent references on facing pages.

In a review of the origins of American medical historiography,[8] Dr. W. B. McDaniel, 2d, has discussed in detail Peter Middleton's *Medical Discourse, or an Historical Inquiry into the Ancient and Present State of Medicine,* delivered at the opening of the medical school of King's College in New York and printed in 1769. Moreover, the historical approach was employed in our two colonial medical colleges in surgical as well as medical teaching. Dr. John Jones (1729-1791), first professor of surgery at King's College, incorporated historical references in his *Introductory Lecture* to his course of surgery in 1769.[9] Famed surgeons and their accomplishments, from Machaon and Podalirius to Wiseman, Cheselden, Monro, and Sharp, were cited in this lecture. It will be recalled that John Jones moved to Philadelphia in 1780. His fame and influence continued to grow, though the presence of Dr. William Shippen, Jr., as professor of anatomy and surgery on the medical faculty, precluded any academic appointment.

In conclusion, it is evident that some account of the general history of medicine—of varying length and scope—was employed in the earliest academic medical instruction in this country, as was the practice in contemporary European teaching. The *Outlines of a General History of Physic,* presented by Dr. John Morgan at Philadelphia in 1765 and here first published, is a rare, early contribution to American medical historiography. Dr. Henry E. Sigerist, in his *Valedictory Address* to The Johns Hopkins Medical History

7 Hodge, John. A compendium of chemistry: historical, theoretical and practical. Being the substance of a course of chemical lectures; delivered by John Morgan, in the year 1766. (Manuscript volume, College of Physicians of Philadelphia.)

8 McDaniel, W. B., 2d. The beginnings of American medical historiography. *Bull. Hist. Med.,* 1952, *26,* 45-53.

9 McDaniel, W. B., 2d. John Jones' introductory lecture to his course in surgery (1769), King's College, printed from the author's manuscript, with an outline of the succeeding lectures and of his notes on the lectures of William Hewson. *Trans. Studies Coll. Phys. Phila.,* 1940, *8,* 180-190.

Club in 1947,[10] summarized this early appreciation of medical history in what was to become the United States of America:

> Until the 19th century medical history on both continents (Europe and North America) was an integral part of medicine. The approach to the past was not a critical historical one, but was taken from a medical point of view. Books were read for their factual content, irrespective of the period at which they were written. Doctors read them in order to learn how to treat their patients, and they thought they could gain practical knowledge from Hippocrates as well as Sydenham. The medical apprentice in America browsing in the library of his teacher found Hippocratic treatises in Latin or English translation, and the modern books he read, the works of Sydenham, Boerhaave, later the physiology of Haller and the works of Brown and Cullen, were full of historical references. When the Medical School of the University of Pennsylvania was founded in 1765 it had no need for a special chair of medical history because all members of the early faculty, Morgan, Shippen, Rush, Kuhn, were well versed in the subject, and in their lectures and writings constantly referred to the past of medicine as a matter of course.

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[10] Sigerist, H. E. Medical history in the United States: past—present—future. (A valedictory address, The Johns Hopkins Medical History Club, May 14, 1947.) *Bull. Hist. Med.*, 1948, 22, 47-64.

# Training of the Nonuniversity-Educated Medical Practitioners in the Later Middle Ages[1]

VERN L. BULLOUGH*

MOST of the medical practitioners in the later Middle Ages did not receive their training in any of the rising university medical schools. It may be assumed that many of these practitioners were quacks, with little or no training, who played upon the fears, superstitions, and gullibilities of the medieval public. There were, however, a number of groups with some medical training or knowledge who treated a great many, perhaps the bulk, of the people in the period. Such groups, the surgeons, the barber-surgeons, and the pharmacists, received their training by apprenticeship, a method which had both advantages and disadvantages as compared to a university education.[2] The advantages can be demonstrated by the names and reputations of a few of the nonuniversity-trained practitioners like John Arderne, Jean Pitard, and that most famous of all, Ambroise Paré. While the available information on such training is very meager, this is an attempt to bring together what is known.

Any discussion of the training of the late medieval surgeon, barber-surgeon, or apothecary, must make an exception for Italy. In Italy many of these groups were admitted to the university,[3] or were more closely regulated by the university practitioner than in most of the rest of western Europe. Both Spain and Germany were rather late in developing their universities or even medical guilds,

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1 This monograph grew out of work first undertaken for my unpublished Ph.D. dissertation, "Medical education in Western Europe during the thirteenth and fourteenth centuries" (University of Chicago, 1954). I should like to express my indebtedness to Professors James L. Cate and Ilza Veith for their advice and encouragement. Professor Sylvia Thrupp also deserves credit for arousing my interest in medieval guilds while I served as her assistant. I have restricted the paper to the later medieval period because it is at this time, after the rise of the university, that a real separation occurred in the medical profession. For earlier medieval medical training see Loren C. MacKinney, "Medical education in the Middle Ages," *J. World Hist.*, 1954, 2, 835 ff.

2 For accounts of the various university medical schools see Paul Oskar Kristeller, "The school of Salerno," *Bull. Hist. Med.*, 1945, *17*, 138-194; and various articles by myself, "The development of the medical university at Montpellier to the end of the fourteenth century," *op. cit.*, 1956, *30*, 508-523; "The medieval medical university at Paris," *op. cit.*, 1957, *31*, 197-211; "Medieval Bologna and the development of medical education," *op. cit.*, 1958, *32*, 201-215.

3 *Ibid.*, pp. 202 ff.

so that this paper is based for the most part on France and England. In both of these countries, while each local group had some independence, there was increasing royal control making for unity.

## The Surgeon

The surgeon was not necessarily a better surgeon than a barber-surgeon, but rather was distinguished from him by his clothes and his prestige. Surgeons were entitled to wear a long robe, in imitation of the university-trained physician, while the barber-surgeon could wear only a short robe. The surgeon also disdained to do many operations on the grounds that such operations would prove degrading to him.[4] What operations they refused to do are not always specified but include, in France at least, those on boils, tumors, bruises, and minor wounds.[5] The number of surgeons in France was also very small in contrast to the much more numerous barbers, or even surprisingly the university-trained physicians. In England the number was also small but not any smaller than the physicians. In 1435 there were only seventeen members of the Surgeons' Company in London.[6] Paris had only nine members in its surgeons' guild in 1355,[7] while in 1396 there were but ten. At this latter date there were thirty-one physicians regent on the medical faculty, plus the nonregent physicians, and at least forty barber-surgeons.[8] Outside the larger French cities, and in England, outside of London itself, there were few if any surgeons. Most of the surgery, and even medicine, was carried on by the barber-surgeon.[9]

While there is some controversy[10] about the time of the appear-

4 Pierre Franco, *Chirurgie,* edited with an introduction by E. Nicaise. Paris, Félix Alcan, 1895, p. cx.

5 *Ordonnances de rois de France,* edited by Eusèbe Jacob de Lauriére, Denis François Secousse *et al.* Paris, 1723-1849, 21 vols., V, 530-31, VI, 197-198. Henceforth this is abbreviated as *Ordonnances.*

6 John Flint South, *Memorials of the craft of surgery in England,* edited by D'Arcy Power. London, Cassell & Co., 1886, p. 313.

7 J. F. Malgaigne, Ed. *Oeuvres complètes d'Ambroise Paré.* Paris, J. B. Baillière, 1840, I, cxxxiv.

8 *Ibid.,* I, cxlii, cxxxiv.

9 *Ibid.,* I, clv.

10 The controversy revolves around the surgical College of St. Cosmas and Damian (or St. Côme). It is based, at least in my opinion, on the attempts of the surgeons to show that they were both more ancient and more worthy than their rivals, the university-trained physician. Most of the supposed proofs for this claim can be found in [François Quesnay] *Recherches critiques et historiques sur l'origine sur les divers états et sur les progrés de la chirurgie en France* (Paris, Charles Osmont, 1744). He attempted to trace the organization of the surgeons back to the year 1033 when he claimed names of master surgeons were first recorded. This list of surgeons, if it ever existed, had disappeared by the end of the sixteenth century so that Quesnay's claim was based on hearsay evidence which seems doubtful. Further doubt on the claim appears from the fact that the supposed list included the names of masters, licentiates, and bachelors in surgery, titles which do not appear elsewhere until the fourteenth century. Perhaps even Quesnay doubted his evidence, for

ance of a surgical organization in France, the first authenticated ordinance dates from 1258.[11] Previous to this time some loose-knit organization might have existed, but control over surgical training would be almost impossible without official recognition. Earlier training had probably been on the basis of apprenticeship but without regulation it would vary widely. This is demonstrated by the ordinance itself since the reason for its issuance was to prevent so many inadequately trained people from imperiling the lives of the people by the practice of surgery. Hereafter all surgeons desiring to practise in Paris were to be examined by the provost of Paris, assisted by six good and loyal surgeons, chosen by the surgeons themselves.[12] But exactly what this examination included was not stated.

In 1311 the king himself, at that time Philip IV, intervened in the development of surgery by requiring all surgeons to be examined by the master surgeons. His ordinance gives an indication that women, excluded from becoming physicians because of their lack of clerical status, could become surgeons for there is a reference to *chirurgicus* and *chirurgica*.[13] The surgeons' battle to achieve recognition equal to that of the physicians was climaxed by King John's ordinance recognizing the surgeons as a faculty in 1356.[14] By 1370 the imitation of the university faculty was completed by Charles V's recognition of masters, licentiates, and bachelors of surgery.[15]

he was willing to admit that this early surgical organization soon disappeared only to be refounded by the saintly king of France, Louis IX. He argued that Saint Louis on the urging of his surgeon, Jean Pitard, established a surgical college, the College of St. Cosmas and St. Damian, to avert conflicts among the surgeons. By this claim the surgeons had both a saintly founder and one of the most famous of medieval surgeons. One of the difficulties in accepting this claim, besides the lack of documentation, is in demonstrating a united plan of action between Pitard and St. Louis. Pitard died sometime after 1327-28 and even if at the time of his death he had been in his nineties, he would have had to have been an extremely precocious surgeon to accompany Louis IX on his crusade (1248-1254) as claimed, then return to organize the surgeons' college. See Vern L. Bullough, "The development of the medical guilds at Paris," *Medievalia et Humanistica*, 1958. *12*, 33-40.

11 Etienne Boileau, *Le livre des métiers*, edited by René de Lespinasse and François Bonnardo ("Histoire générale de Paris," Paris, Imprimerie Nationale, 1879), pp. 208-209. This ordinance would indicate the existence of a surgical organization at the time of St. Louis, but Quesnay refused to accept its authenticity. Perhaps the reason for his refusal was that the document casts doubts on his theories for the antiquity of the surgeons and for a founding by St. Louis himself. The editor of the ordinance, Lespinasse, accepts it as authentic (*ibid.*, pp. 208ff.), as does J. F. Malgaigne, *op. cit.*, I, cxxii. My own research would tend to confirm its authenticity. The exact date of the appearance of the surgical organization cannot be shown from the documentation.

12 *Ibid.*, p. 209.

13 *Ordonnances*, I, 491-492.

14 René de Lespinasse, Ed., *Les métiers et corporations de la ville de Paris*. Paris, Imprimerie Nationale, 1886-1897, 3 vols, "Histoire générale de Paris," III, 629.

15 *Ordonnances*, V, 322-323.

Even though the apprenticeship of the surgeon came under regulation, there was no stipulation as to what the surgeons should study or do. Such information must be gained more indirectly. Some light on this can be gained from the fact that the surgeons in Paris were required to know Latin, at least by the end of the fourteenth century.[16] If this requirement was enforced, it would have enabled the Parisian surgeons to consult the standard Greek and Arabic surgical works in Latin translations. But whether this was the case is not known and even if this did happen, no such requirement was stipulated for surgeons outside of Paris. Some other source of information would have to be available. This might well be the works of various outstanding surgeons who practised in Paris at one time or another. Probably the most influential of these was Lanfranc who has been called the *"veritable createur de la chirurgie en France."*[17] Lanfranc, banned from his native Milan by the Visconti, had fled first to Lyons, then in 1295 to Paris, where he was soon attached to the royal household. His *Surgery* was based to a large extent on the work of his master, William of Saliceto, which in turn leaned heavily on the Arabs. This would give a solid basis for surgical training. But more important, William's work (and thus Lanfranc's) included some first-hand observations,[18] which might encourage later surgeons to do some independent thinking. Following Lanfranc to Paris was Henri de Mondeville, a graduate of Montpellier, who also became a royal medical adviser. Since Lanfranc was closely connected with the surgical guild, there is little doubt that his work was used, and so probably was the *Surgery* of Mondeville.

The fact that these surgical treatises were available for study is evidenced by the fact that they were often translated into vernacular languages in the fourteenth and fifteenth centuries. Lanfranc's *Surgery*, for example, appeared in English in about 1380[19] followed by translations of William Saliceto, Henri de Mondeville, and Guy de Chauliac.[20] An English surgeon like John Arderne, even though lacking a university training, could acquire enough of the past sur-

16 *Quesnay*, op. cit., p. 70.

17 Malgaigne, *op. cit.*, I, xliv.

18 Charles Singer, *A short history of anatomy and physiology from the Greeks to Harvey* (republication of the 1925 edition, *The evolution of anatomy*). New York, Dover, 1957, p. 72.

19 There is an Early English Text Society edition of Lanfranc. See Lanfrank, *Science of cirurgie*, edited by Robert von Fleishhacker (vol. CII, London, 1894).

20 Singer, *op. cit.*, p. 170.

gical knowledge to publish his own imitative surgical work,[21] an indication of the widespread distribution of the other surgical works. But even though these works might have been studied, there is no detailed account of teaching methods.[22] Probably these methods included observation, reading in surgical works, assisting at operations and treatment, and finally the actual performance of minor and then major operations under the supervision of the master.

At what age the surgeons started their apprenticeship is not given in any of the documents nor is the number of years such training required. Undoubtedly they started early, probably in their early teens, but how long they served is debatable. Other French guilds had a wide variation in the apprenticeship period ranging from two to seven years, so this gives us no evidence for the surgeons. However, the rival barber-surgeons in France came to be apprenticed for a minimum of four years,[23] an indication that surgeons would serve at least that length of time. In England where surgical groups had been active in London since the middle of the thirteenth century[24] and an organized body after 1368,[25] apprenticeship was set at six years. In the fifteenth century document in which this information appeared, the procedure for becoming a journeyman is also given. The apprentice was to be given his freedom only after being called before four masters who charged him

> . . . to be rulid & gouerned bi the seid craft. And thanne as he goodli mai to ȝeue[26] iijs & iijd to the box. And also that no sich persoons be made mastir of the craft withinne the teerme of six ȝeer aftir his entringe & in all the seid terme he be proued wel gouerned & honest wys & secreet & ellis he not to be ressiued to bere the office of maistirschip withinne over vj ȝeer and if he be not founded bi tho xij jeeris well rulid in manner forseid he neuere to be chosen maistir.[27]

[21] See the Early English Text Society edition, John Arderne, *Treatises of fistula in ano, haemorrhoids, and clysters,* edited by D'Arcy Power (vol. CXXXIX. London, Kegan Paul, Trench, Trubner & Co., 1910).

[22] A. Corlieu, *L'enseignement au collège de chirurgie depuis son origine jusqu'à la révolution Française.* Paris, J. B. Baillière et fils, 1890, p. 1.

[23] *Ordonnances,* XIII, 265-267.

[24] *Calendar of libertate rolls preserved in the Public Record Office, Henry III.* London, H. M. Stationery Office, 1916-1937, III, 348-391; *Calendar of letter-books preserved among the archives of the Corporation of the City of London at the Guildhall. Letter-book A. Circa A.D. 1275-1298 to Letter book I. Circa A.D. 1400-1422,* Reginald R. Sharpe, Ed. (London, John Edward Francis, 1899-1909), *Letter book D.,* p. 47. Henceforth cited as *Letter book.*

[25] South, *op. cit.,* p. 17; see also Henry Thomas Riley, *Memorials of London and London life.* London, Longmans Green, and Co., 1848, I, 337.

[26] The ȝ is used here as a corruption for the Anglo-Saxon g. This letter, similar to the modern ȝ, is found in English MSS written after the twelfth century. It sometimes corresponded to our g, other times to y, sometimes to gh, or to a mute consonant at the beginning of a word. In the middle of a word it occasionally stood for i.

[27] South, *op. cit.,* p. 311.

Apprenticeship was to last six years after which some could be admitted directly to the craft while others might have to undergo another six-year trial period. Probably sons of masters could become masters without these additional six years as a journeyman, but others had to serve such a period. Longer apprenticeships, however, were not unusual.[28] How regularly such terms of apprenticeship were applied is impossible to find, but an indication that other areas in England and France might have had somewhat the same general rules is indicated by the possibility of transfer from one city to another. A fifteenth century regulation stipulated that any foreigner (*foreyns*) desiring to establish himself in surgery in London had to be examined by the masters of the craft who passed on his ability.[29] It seems safe to say that in France, at least four years' apprenticeship was required with a strong possibility of six years. A sixteenth century regulation in France required an interval of four years after the licentiate before the master's status could be achieved.[30] Thus from eight to twelve years might elapse before one became a master.[31]

The French surgeons through their organization, the College of St. Cosmas, continued to exert influence. In England, however, the independent surgeons were incorporated into the barbers guild or joined forces with it in 1493.[32] Independent surgical training was mainly a French development. But even though several statutes for the late fourteenth and fifteenth centuries dealing with the College of St. Cosmas are extant, they add very little to our knowledge of the educational requirements for surgeons.[33] They do reinforce the theory that apprenticeship was the means of training. After fulfilling his apprenticeship, the prospective surgeon became a bachelor—that is, he was admitted into the brotherhood and swore to observe the guild statutes. For this he paid one franc. His status was in many ways that of a journeyman, but he could not yet practise surgery. This required a license. How long a period elapsed

28 At the beginning of the fourteenth century, Robert, son of William Newcomen, served ten years as an apprentice to a surgeon which was not regarded as unusual. *Letter book D*, p. 47. Later in the fifteenth century an apprenticeship of nine years was recorded. See *A descriptive catalogue of ancient deeds in the Public Records Office*. London, H. M. Stationery Office, 1890-1915, I, 542.

29 South, *op. cit.*, p. 311.

30 Malgaigne, *op. cit.*, I, cxxviii-cxxxiii.

31 This would include a minimum of four to six years for the apprenticeship and the same period as journeyman or licentiate.

32 *The annals of the barber-surgeons of London*, compiled by Sidney Young. London, Blades, East & Blades, 1890, p. 24. Hereafter referred to as *Annals*.

33 Malgaigne, *op. cit.*, I, cxxxi; Quesnay, *op. cit.*, pp. 393-394; Pierre Franco, *op. cit.*, p. cxvi; Henri de Mondeville, *Chirurgie*, edited and translated into French by E. Nicaise. Paris, Félix Alcan, 1893, pp. lxx-lxxv.

between the bachelorship and the licentiate is not stated but it probably was not very long. Perhaps the licentiate ceremonies served a similar function to the licentiate degree in the university. That is, the guild held a veto over any prospective candidate by its right to grant the bachelor's degree, while the state held the same power by the licensing ceremonies. To receive the licentiate the would-be surgeon appeared before the provost of the city, was examined, gave an oath, paid his fees, and then was licensed. He then had complete journeyman status. He had to act as a journeyman for at least four years before he could become a master.[34] The mastership allowed him to go into practice for himself. Similar statutes appeared for other areas in France.[35] By 1390 the University of Paris had recognized the surgeons of St. Cosmas as true scholars, at least according to the surgical historians of a couple of centuries ago. The medical faculty contested this claim in the eighteenth century,[36] and no text for such recognition has yet been found.

The surgeons of the long robe had certain advantages in education over the physicians in that they by the nature of their profession knew anatomy. They also, because of their learning, knew theory. In France they never capitalized on their greater knowledge to go beyond the theoretical base of the physicians. Instead they seemed to be more concerned with their status than with adding to medical knowledge; much of their effort was spent in trying to match the social prestige of the physicians. In England they disappeared or amalgamated with the barbers. It seems that medical progress might have been somewhat retarded because the surgeons, with all their learning and their practical training, never really revised the work of their predecessors. This revision was done by the Italian university-trained surgeon or later by the barber-surgeons. Perhaps the barber-surgeons went much further in this direction than the physicians because they were not so handicapped by the search for status symbols.

## BARBER-SURGEONS

In France the barbers rose to importance later than the surgeons. One of the reasons for their sudden growth in importance was because of the increasing limitations and restrictions that the surgeons applied to themselves. While there are numerous refer-

[34] Malgaigne, *op. cit.*, I, cxxviii-cxxxiii.
[35] *Ordonnances*, IX, 26; XIV, 281-284; XVIII, 256-258.
[36] M. Crevier, *Histoire de l'université de Paris*. Paris, Desaint & Saillant, 1761, V, 52-54.

ences to barbers in the fourteenth century,[37] the first effective regulation was not until 1371 when King Charles V legislated for the community of barbers in Paris.[38] In these statutes the *"premier Barbier & Valet de Chambre"* of the king was given supervision of all the barbers in Paris, assisted by lieutenants of his own choice. All who wished to practise barbery were examined by the king's barber and his lieutenants according to the customs of the period, which were not defined. The only reference to apprenticeship in these statutes was the frequent one stipulating that no barber should attempt to take the apprentices of a fellow barber. Similar regulations were issued in 1400 for the barbers of the city of Carcasonne by Charles VI requiring examination before the king's representative,[39] as did regulations for the barbers of Tours and Rouen.[40] Apparently the regulations for the Parisian barbers set the precedent for the others.

In England proof of the existence of a barber's company can be found somewhat earlier than that for Paris or, for that matter, than the existence of the English surgeons guild. The first mention of a guild is in 1308,[41] although there are numerous references to barbers earlier.[42] The first reference to an organized company was an attempt to disassociate barbers from brothels, a not uncommon relationship for the medieval barber-surgeon who often owned, managed, or practised in public baths, notorious haunts of prostitutes. In England the barbers guild had at least two classes, those who practised barbery proper, including phlebotomy and dentistry, and those who practised surgery. The latter were called barber-surgeons.[43]

In 1438 an apprenticeship term of not less than four years was set for French barbers,[44] after which each apprentice was to be examined by representatives of the king's barber. This official appointed lieutenants in each town to examine the apprentices with the assistance of the local guild officers.[45] Most of the London guilds

37 Lespinasse, *op. cit.*, III, 628.
38 *Ordonnances*, V, 340-342.
39 *Ibid.*, VIII, 399-405.
40 *Ibid.*, IX, 404-406; XIII, 60-64.
41 *Annals*, p. 24.
42 *Rotuli parliamentorum: ut et patitiones, et placita in parliamento*. London, 1767-1777, I, 19, col. b; G. A. Auden, "The guild of barber surgeons of the city of York," *Proc. roy. Soc. Med.*, 1927-1928, *21*, 1400-1406. There is some difficulty in determining the earliest appearance of barbers in the records because of the popularity of the surname Barber. Some with such a name are barbers but the great majority are not.
43 *Annals*, p. 29.
44 *Ordonnances*, XIII, 128-131.
45 *Ibid.*, XIII, 128-131.

required a seven years' apprenticeship,[46] but there is no London barber guild regulation stipulating this period during the Middle Ages. The fifteenth century statutes of the barber-surgeons of York as revised and augmented in 1592 and 1614 set apprenticeship at seven years,[47] but this might have been added later. There are, however, some other indications that seven years was not an unusual length even in the medieval period. In 1311 Richard Elys de Braye, late apprentice of Richard le Barbier of All Hallows, was admitted to freedom after seven years of apprenticeship.[48] In that same year a Thomas de Mangrave testified that he had served Richard le Barber of Bredestrete for twelve years as an apprentice.[49] In both cases there is no certainty that Richard le Barber or Barbier was a barber by trade but there was a Richard le Barber active in the London barbers' guild then.[50] The French regulations stated a minimum of four years, possibly indicating a normally longer period. Perhaps sons of barbers, or widows of barbers (barbers' widows were allowed to practise their husband's craft if they were of good reputation),[51] were permitted to start practise after the minimum period, while others might have had to serve longer.[52]

When an apprentice in England had finished his term, he entered the yeoman or freeman class as a journeyman or varlet. Much the same situation prevailed in France. The number of masters was limited; this is indicated by the fees required to obtain that office, although these varied considerably.[53] Even though a journey-

46 *Munimenta gildhallae Londinensis,* Henry Thomas Riley, Ed. Rolls Series; London, Longman, Green, Longman, and Roberts, 1859-1862, III, 90. See also Toulmin and Lucy Toulmin Smith, *English guilds: the original ordinances of more than one hundred early English guilds* with a historical introduction by Lujo Brentano (Early English Text Society, o.s. vol. XL, London, N. Trubner & Co., 1870), pp. 209-390. This volume also includes a short return from the Barbers Guild at Norwich for 1389 (*ibid.,* p. 27). The introductory essay by Lujo Brentano was also printed separately under the title, *On the history and development of gilds and the origin of trade-unions* (London, Trubner & Co., 1870). Brentano estimated that the average apprenticeship period for most guilds was about seven years in England, from three or four to six years in Germany (*ibid.,* p. 65). George Unwin, *The gilds and companies of London* (London, George Allen & Unwin Ltd., 1908, pp. 85, 91), implies that the period was at first longer but was apparently gradually shortened to seven years.

47 Thomas Vicary, *The anatomie of the bodie of man,* edited by Frederick J. Furnivall and Percy Furnivall (Early English Text Society, o.s., LIII, London, N. Trubner & Co., 1888), p. 275. See also Charles Williams, "The ordinances of the gild of barber-surgeons of Norwich," *The Antiquary,* 1900, *36,* 293-295.

48 *Letter book D,* p. 159.

49 *Ibid.,* p. 151.

50 *Annals,* p. 24.

51 *Ordonnances,* XIII, 128-131.

52 Special provisions were usually made for the children of the guild member as well as his wife. This led in some guilds to sort of family monopolies. See Brentano, *op. cit.,* p. 68.

53 *Annals,* pp. 256-257.

man was a freeman, he could not set up a shop of his own nor could he take apprentices, the prerogatives of a master. To become a master the journeyman had to possess an unspecified amount of goods besides paying a fee.[54] Journeymen unable to become a master in one town might move to another town but here they ran into difficulty also, as an Oxford ordinance would seem to indicate. This stated that foreigners coming into Oxford who had not served their apprenticeship there were required to give all the masters a dinner, pay twenty-six shillings in cash to the guild plus one pound of wax (for candles), and then take an oath to respect and keep the ordinances of the Oxford guild.[55] Many medical journeymen never did become masters.

In England there is little in the ordinances about the required knowledge of a barber's apprentice, but a minimum requirement is included in a French ordinance of 1457. Here the barbers were to be examined on their knowledge of anatomy and the treatment of wounds, fractures, dislocations, boils, and all maladies which afflicted humans. They were also to know all things pertaining to the art of surgery including the herbs and condiments necessary for ointments and plasters.[56] Apprentices were bound not to attempt a cure except in the presence of a master.

Where did barbers acquire such knowledge? Obviously most of it came from practical experience. But it is possible that the barbers also received some theoretical training. For example, in Paris the barbers received special instruction from the faculty of medicine at the University of Paris.[57] Such lessons were probably an attempt of the medical faculty to weaken the position of the surgeons. This is indicated by the fact that they were carried on in utmost secrecy until near the end of the fifteenth century when the faculty taught more openly. They read the surgical works of Guy de Chauliac and others, first in Latin but then translated into French.[58] That such lessons were not limited to Paris is indicated by the fact that there is some evidence, although debatable, that the London company of barbers in the fourteenth century gave lectures

54 *Ibid.*, p. 273.

55 E. E. Salter, *Records of medieval Oxford: coroner's inquests, the walls of Oxford, etc.* Oxford, The Oxford Chronicle Company, Ltd., 1912, p. 72.

56 *Ordonnances*, XIV, 427-433.

57 *Commentaires de la faculté de medécine de l'université de Paris (1395-1516)*, edited by Ernest Wickersheimer. "Collection de documents inédits sur l'histoire de France": Paris, Imprimerie Nationale, 1915, p. xxxv.

58 *Ibid.*, p. 353.

and demonstrations in anatomy to increase the knowledge of both members and apprentices. Because no record of such procedure is available until near the end of the fifteenth century,[59] it seems possible that this might have started as a result of the surgeons joining forces with them in 1493.[60] Quite possibly, however, such lectures existed much earlier. Perhaps the barbers became better educated as they attempted to raise the standard of their craft. There is little doubt that outside of a few large cities in France and England most of the legitimate medical practitioners were barber-surgeons.[61] It also appears probable that barber-surgeons could gain a great deal of experience in the growing number of hospitals in the late medieval period. Ambroise Paré achieved some valuable training there indicative of the possibilities. The practice of using surgeons in the hospitals had perhaps started with the Knights Hospitaller[62] but it was fairly widespread by the end of the fifteenth century.

Increasingly, then, the barber-surgeons raised their standards. Perhaps in some ways they were able to progress faster than the more learned surgeons of the long robe because they did not have the whole tradition of learned medieval medicine behind them. An inquiring barber-surgeon like Paré could experiment, and by his very willingness to learn from this rather than from tradition, could overcome the limitations of his training.

## APOTHECARIES

Apothecaries and herbalists were mentioned in the thirteenth century in Paris, where they were accused of practising medicine illegally.[63] The physicians were much more concerned about the activities and training of the apothecaries than any other medical group, perhaps because they were so dependent upon them for their prescriptions. University control over the apothecaries in Paris was assured by the King himself who in 1353 authorized the medical faculty to inspect the shops of the apothecaries.[64]

59 *Annals*, p. 361.

60 *Ibid.*, pp. 66-68 and South, *op. cit.*, p. xxvi.

61 Malgaigne, *op. cit.*, I, cxxxv.

62 Edgar Erskine Hume, *Medical work of the Knights Hospitallers of Saint John of Jerusalem*. Baltimore, Johns Hopkins Press, 1940, p. 51.

63 *Chartularium Universitatis Parisiensis*, edited and annotated by Henry Denifle and Aemelio Chatelain. Paris, Delalain, 1889-1897) I, No. 434, 489. Previous to this the apothecaries and spicers probably belonged to the same groups. See Lespinasse, *op. cit.*, I, 496. Hereafter referred to as *Chartularium Parisiensis*.

64 *Ordonnances*, II, 532-535; Lespinasse, *op. cit.*, I, 504-505.

In England apothecaries appear from at least the last part of the thirteenth century.[65] They were organized by 1312.[66] While training for apothecaries was by apprenticeship, little information is extant on how they were trained. A certain Richard Smith spent ten years as an apprentice in learning the art of the apothecary in the sixteenth century.[67] This seems to be rather extreme for in France the normal apprenticeship period was four years.[68] It was necessary for the apothecary to read Latin in order to fulfill prescriptions. All masters of the craft in France were required to be able to read the *Antidotarium* of Nicholas and the *Quid pro Quo* in case any of the necessary ingredients had to be substituted.[69]

Before being allowed to become an apprentice, a youth was required to pay twelve *sols* Paris to the brotherhood of the masters. On completion he paid one hundred *sols* Paris of which sixty went to the Church, twenty to the king, and twenty to the master examiners of the guild. Sons of apothecaries were exempted from the sixty *sol* payment to the church.[70] Apothecaries were frequently inspected and heavily regulated in the later medieval period, but most often these inspections and regulations deal with their weights or the freshness of their drugs.[71] Even though many of the hospitals came to have an apothecary shop, most of the apothecaries seem to have been confined to the larger cities. Outside of Paris in France, or London and the university towns in England, there is very little reference to them.

In conclusion, then, there seemed to have been some sort of regularized medical training emerging for these various practitioners by the end of the medieval period. On the whole the training was much more pragmatic than that in the university, but the

65 There is some difficulty in determining just when apothecaries first appeared because indexes of the various *Calendars* often classify them under spicer if they list them at all. There were spicers from at least early in the thirteenth century. At times the term spicer appears to be synonymous with apothecary. See for example, *Calendar of libertate rolls preserved in the Public Record Office*, I, 246, 254; H. E. Salter, Ed., *Mediaeval archives of the University of Oxford*, Oxford Historical Society, *Publications*, LXX. Oxford, Clarendon Press, 1920, 290, 305-312.

66 In that year men of the apothecaries' trade as well as those of the ironmongers, pepperers, corders, and others who "busy themselves with heavy merchandise *(se intromittunt de averio ponderis)*" presented Andrew Godard for the office of weigher of the Great Beam; *Letter book D*, p. 296. It seems odd that the apothecaries were among those in charge of the Great Beam which was used for weighing heavy objects rather than the Small Beam, but apparently both beams were used by them. The Small Beam was used for the weighing of spices in small quantity while spices sold in bulk were weighed on the Great Beam. *(Ibid.*, p. 100, note 1.)

67 Robert T. Gunther, *Early science in Cambridge*. Oxford, University Press, 1937, p. 328.

68 *Ordonnances*, XIX, 413-418.

69 *Chartularium Parisiensis*, II, No. 817, 268.

70 *Ordonnances*, XIX, 413-418.

71 Lespinasse, *op. cit.*, I, 500-504.

learned tradition, even among the barber-surgeons, was not entirely forgotten. The most learned of these practitioners were the master surgeons but their very learning perhaps served as a handicap to them because of their attempts to achieve status and recognition equal to their learning or to the university-trained physician. To do this they increasingly neglected their real advantage over the physicians, namely, their better knowledge of anatomy and bodily processes.

The barber-surgeons increasingly grew in both numbers and power as the surgeons became more 'status conscious.' While at first the barber-surgeons might have been ignorant of the learned tradition, they gradually became conscious of it and adapted it to their own use. Because they kept in close contact with the body processes, they were able to change and eventually improve on the learned tradition. Paré perhaps is an example of this. Unfortunately, they often did not have enough prestige to carry the field against the more learned surgeons or physicians. The apothecaries, while not as numerous as the barbers, had established a regulated training system and completed a close alliance with the physician. This alliance, which later weakened, did help to set standards for the profession.

# Lionel Wafer—Surgeon to the Buccaneers*

RONALD A. MALT**

WHEN news of the peace treaty of 1670 reached buccaneer Henry Morgan and his "Brotherhood of the Coast," the only problem it posed was the choice of a Spanish city to plunder for an appropriate show of disrespect. Panama, the southern end of El Camino Real, was the richest prize, and of course it was also the most dangerous. So the matter was settled.

Incited by the tales of spoils gained at Porto Bello the year previous, the rascals of the Indies and "all the ancient and expert pirates inhabiting Tortuga"[1] joined willingly with Morgan for the first expedition to the South Sea in nearly a century. The venture proved a great success in spite of the Spaniards' having removed their municipal treasures before the invaders came. The 175 mules of the victors left weighted with the townspeoples' valuables instead.

In the next years the serious attempts of the English to restrain the buccaneers gave little chance for imitation of Morgan's exploits, but by 1679 the opportunity came again. Captains John Coxon and Bartholomew Sharp with the aid of the Cuna Indians of Darien sacked Porto Bello. The yield was not so large as Morgan's had been. Still it was enough to conjur up visions of more to come in ". . . that old breed of rover whose . . . concern was not to preserve life 'but rather to squander it away'; to fling it, like so much oil, into the fire for the pleasure of going up in a blaze."[2]

## Wafer Ships with the Buccaneers

Into this breed, new but willing to try his hand, came Lionel Wafer, the young surgeon from Scotland and Ireland. He was no more than nineteen or twenty years old when he sailed from Port Royal, Jamaica, as surgeon to the buccaneers, but already he had served a term as loblolly boy (surgeon's assistant) on a trading voyage to Java, Sumatra, and Borneo and had established a practice in Port Royal with his brother's backing. Wafer's reasons for sail-

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1 Verrill, *In the wake of the buccaneers*, p. 350.

2 Masefield, *On the Spanish main*, p. 290.

ing with the buccaneers are not clear; however, one would not be surprized if Governor Thomas Modyford, his brother's employer and staunch encourager of the privateers, had a part in the decision.

At any rate, in early 1680 he was aboard the craft of Captains Lynch and Edmund Cook when they rendezvoused at Boco del Toro with the Anglo-French forces just back from the conquest of Porto Bello. Here, plans for the next assault were devised. Some of the ships elected to remain in the familiar Caribbean, but the majority were for adventure across the Isthmus.

Over 300 of these men were landed on the mainland across from Golden Island on 5 April. Leaving Captains Allison and Mackett in charge of guarding their ships, the rest of the buccaneers and their Cuna guides began the overland march. Among this adventurous crew were the future chroniclers William Dampier, Basil Ringrose, and Wafer, but there is no evidence to show that they were set apart in any way. For each man the provisions were two pounds of flour, four journey cakes boiled in sea water, a musket, pistol, and hanger.

Sixty crossings of the tortuous Chucunque River and an empty victory at Santa Maria were all they had to show for the exertion of the first ten days. In the next few, however, they reached the South Sea and in daring raids parlayed their native canoes to barks and their barks to Spanish ships of the line. They needed only to await the arrival of the treasure ship from Peru to attempt the greatest coup of all.

Unfortunately for some, prospects of the future could not mitigate the poverty of the present. The disgruntled Coxon persuaded some 50 men and many Indians to go back as they had come and, when he left, he had no scruples about taking the best of the surgeons and their medicines. That Lionel Wafer remained speaks of the value placed on young surgeons even in the seventeenth century.

Yet the buccaneers must have been glad to have whatever doctors they did. Doctors were precious. Whenever a prize was captured, the crew might be given its liberty, but the surgeon was nearly always held with the victor until further conquests brought a replacement on board. Whether captured or signed on freely:

> The chirurgeon had to bring on board his own instruments and medicines, and to keep them ready to hand in his cabin beneath the gun-deck, out of all possible reach of shot. He was expected to know his business, and to know the remedies for those ailments peculiar to the lands for which the

ship intended . . . An assistant, or servant, was allowed him, and neither he, nor his servant did any duty outside the chirurgeon's province.[3]

Even when buccaneering degenerated into rank piracy and brutality in the eighteenth century, the most vicious captains maintained respect for the healer:

Captain Low happened to be aboard at the time, and in the mixup one of the pirates slashed him across the lower jaw, laying bare his teeth. Low complained bitterly about the way the surgeon sewed his jaw up. Enraged, the surgeon smashed him across the mouth, bidding him sew up his own chops. As the surgeon was a necessary member of the ship's company, Low accepted the affront in silence.[4]

Following Coxon's departure the remaining ships attempted an unsuccessful raid on the mainland, losing Captain-in-Chief Sawkins in foray. Under Captain Sharp in the flagship *Blessed Trinity*, they sailed for the South on 6 June, took Hiló, Peru, on 28 October, La Serena on 3 December, and spent Christmas in the Juan Fernandez Islands.

The New Year began with quarrels over leadership. Watling displaced Sharp as commander; however, in the assault on Arica, in which three surgeons were captured, he himself died of a shot in the liver. The survivors continued north to Isle de Plata. By this time the "meaner sort" in the crew wanted to choose Sharp commander again, but "the abler and more experienced men"[5] would not consent. Party lines were drawn. Whichever side carried the majority was to keep the large ship, and the others were to seek their fortune in the smaller craft.

So it was that on 17 April 1681, Dampier, Wafer, Captain John Cook, and 41 other white men, three Indians, and five slaves departed for the Gulf of San Miguel in canoes and long boats; the next day a bark was captured. The 600 miles on the open sea were covered in 13 days only to find that the Spanish were diligently awaiting their return. A landing was therefore made near secluded Cape St. Lorenzo on 1 May. The ship was sunk and the arduous trek back begun.

Except for some notes on Wafer's first oceanic excursions, what is known of his buccaneering ventures to this point comes from the narratives of Ringrose[6] and Dampier.[7] Ringrose's account appeared

[3] Monson, W. *Naval tracts.* Quoted by Masefield, J., *op. cit.*, p. 321.
[4] Snow, *Pirates and buccaneers of the Atlantic coast*, p. 189.
[5] Dampier, *A new voyage round the world*, 1698, p. v.
[6] Ringrose, *Bucaniers of America*, etc. London, William Crooke, 1685. xi, 212 pp. This volume was originally published as the second part of Esquemeling (see note 8).
[7] Dampier (1698), *op. cit.*

while Dampier and Wafer were still at sea. It apparently described the events until the author elected to stay with Sharp accurately enough so that later neither of his shipmates felt obligated to enlarge upon what was already in print. The first part of Dampier's description, beginning at the parting with Sharp, appeared two years before the publication of Wafer's *New Voyage,* and once again there was no need for the later report to correct the earlier.

The fame of Lionel Wafer rests almost entirely upon a description of the period following his accident, of which more below, when he was split off from the main group crossing the Isthmus and lived among the Cuna Indians for four months. There were no other accounts to confirm Wafer's narrative. However, two centuries later, when Pinart, Gassó, Pittier, and Prince made their social and anthropological expeditions to the Cuna people, they found the customs and the language almost identical with Wafer's description of them. His accounts of the geography, climate, flora, and fauna, related with scientific restraint, are almost all consonant with modern-day experience. How different from the work of the most well-known buccaneer-surgeon, Alexander Esquemeling, whose sensational account of Morgan's expeditions did not even stand the test of a libel suit brought against his publishers![8]

## STRANDED ON THE ISTHMUS

The accident that precipitated Wafer's stay among the Indians occurred on 5 May. Wafer was sitting near a man drying gunpowder when "a careless fellow"[9] dropped a spark and ignited the mass. A great deal of the surgeon's thigh was scorched and his knee and leg burned so badly that bone was exposed. Some commentaries have made a great deal of the double peril to which Wafer's calamity exposed him, for it is true that the unwritten compact of the band specified death to any who were disabled, lest they be captured and reveal the route of the march. In actuality, Wafer had no fears on this account. Both he and Dampier knew that the penalty was announced purely to repel those who were not wholly in accord with their feelings towards Sharp and to discourage strag-

[8] Esquemeling, J. (actually A. O.). *Bucaniers of America: or, a true account of the most remarkable assaults committed of late years upon the coasts of the West-Indies, by the bucaniers of Jamaica and Tortuga, both English and French. Wherein are contained more especially, the unparallel'd exploits of Sir Henry Morgan, our English Jamaican hero, who sack'd Puerto Velo, burnt Panama, &c.* Translated from the Dutch. London, William Crooke, 1684. x, 390 pp.

[9] Dampier (1698), p. 15.

glers in the march.[10,11] Indeed, Wafer was treated most generously: ". . . wherefore we allowed him a Slave to carry his things, being all of us the more concern'd at the accident; because lyable our selves every moment to misfortune, and none to look after us but him."[12]

Troubles were soon compounded by the defection of the slaves. One of those who ran away was Wafer's attendant. When he left, taking with him the medicines, instruments, and dressings, he left the surgeon without equipment to dress even his own wound.

By 10 May, Wafer could no longer keep up. Accompanied by Richard Gopson, former druggist's apprentice and scholar who often translated the Greek testament aloud to his fellows, and by John Hingson, mariner, he took leave of the company. The trio was shortly joined by two men who had dropped out earlier, Robert Spratlin and William Bowman.

The main party reached the sea within a fortnight and found there a privateer vessel at La Sounds Key in the French ship led by Captain Tristian. Joyous at being among their kind again, they plied the native guides with gifts and coins—providentially, it turned out, for Lionel Wafer.

Tristian upped anchor, and the company sailed to join eight other buccaneers to the North. Among them were Coxon, met for the first time since his departure the year before, Payne, Wright, Yanky, and Archembo. Dampier and colleagues signed on with the last of these in the only empty billets. They stayed only until they could man a captured Spanish tartan as an English crew under the general command of Wright. At the end of August, they guided the tartan to port at La Sounds Key to wait for Wafer and his companions, if they should make their way to the coast, as the rest of the fleet headed for raids off Cartagena.

In the meantime, native medicine had healed the surgeon. As Wafer described it:

> . . . the *Indians* undertook to cure me; and apply'd to my Knee some Herbs, which they first chew'd in their Mouths to the consistency of a Paste, and putting it on a Plantain-Leaf, laid it upon the Sore. This prov'd so effectual, that in about 20 days use of this Poultess, which they applied fresh every Day, I was perfectly cured; except only a Weakness in that Knee, which remain'd long after, and a Benummedness which I sometimes find in it to this Day. Yet they were not altogether so kind in other respects . . .[13]

[10] *Ibid.*, p. 2.

[11] Wafer, *A new voyage and description of the Isthmus of America*, 1699, p. 7.

[12] Dampier (1698), p. 15.

[13] Wafer (1699), p. 8.

In fact, but for the ubiquitous storybook Indian who sneaked food to them at night and when his fellows were away, they would have been allowed to starve.

As Wafer's wound healed, the Cunas became impatient for the return of the guides sent along with the main buccaneer party. Their discussions began to center about whether to kill the quintet of stragglers outright or to hand them over to the Spanish. Eventually the limit of their patience was reached, and a fire was prepared for the victims. Fortunately, just at this time a *deus ex machina* in the form of Lacenta, their chief, entered the settlement and persuaded the tribesmen instead to send Wafer and his friends out with more guides to search for the others.

For eight days they crossed dangerous rivers, scrambled up trees to evade flash floods, and hacked their way through dense jungle with only a few berries and sap of palm tree for food. Then:

> As our Hunger was ready to carry our Eyes to any Object that might afford us some Relief, it hapned that we espied a Deer fast asleep: Which we designed if possible to get, and in order to it we came so very near, that we might almost have thrown our selves on him: But one of our Men putting the Muzle of his Gun close to him, and the Shot not being wadded, tumbled out, just before the Gun went off, and did the Deer no hurt; but starting up at the noise, he took the River and swam over.[14]

There was no humor in this encounter for the participants. Weakly they stumbled onward.

At last they came upon an Indian village. As in all good books, it proved to be the one from which they had started, but in the interim the climate of the community had changed. Dampier's guides had returned laden with gifts and full of praise for the English. This time, when the five adventurers set out for the North, they were sent in Indian canoes and requested to go by way of Lacenta's residence.

## A TURN IN FORTUNE

The chief's welcome was most cordial. They were even asked to live at the royal house because the rainy season was near and travelling would be difficult. So they stayed very comfortably until there happened a remarkable bit of luck that even further increased the good opinions held by the Cunas.

> It so happen'd, that one of *Lancenta*'s Wives being indisposed, was to be let Blood; which the *Indians* perform in this manner: The Patient is seated on a Stone in the River, and one with a small Bow shoots little Arrows into the naked Body of the Patient, up and down; shooting them as fast as he can,

[14] *Ibid.*, pp. 22-23.

FIG. 1. Regions frequented by buccaneers (by permission of the Hakluyt Society).

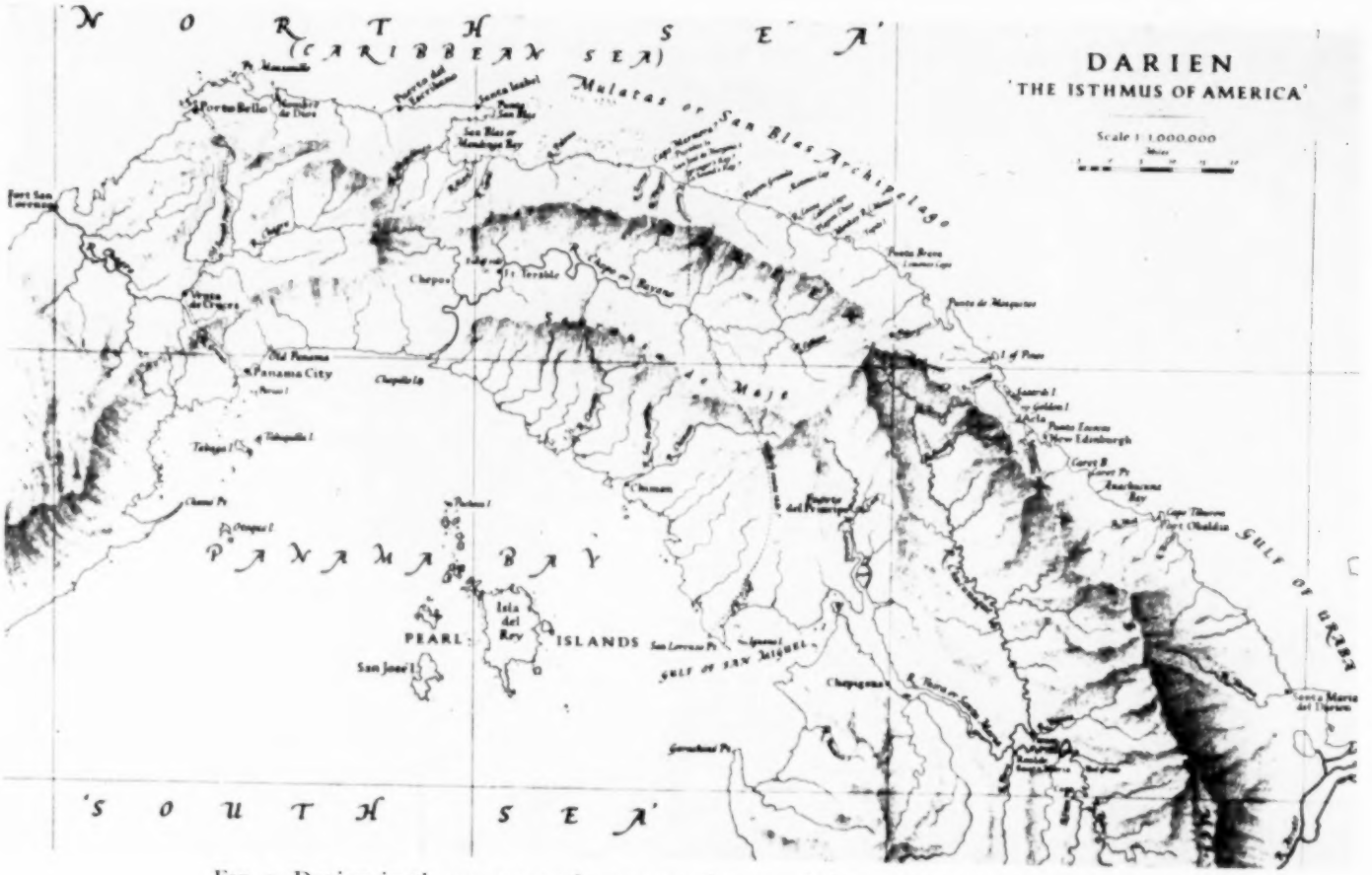


FIG. 2. Darien in the seventeenth century (by permission of the Hakluyt Society).

A NEW

# VOYAGE AND DESCRIPTION OF THE *Iſthmus* of *America*,

Giving an Account of the

AUTHOR's *Abode* there,

The *Form* and *Make* of the *Country*, the *Coaſts*, *Hills*, *Rivers*, &c. *Woods*, *Soil*, *Weather*, &c. *Trees*, *Fruit*, *Beaſts*, *Birds*, *Fiſh*, &c.

The *Indian Inhabitants*, their Features, Complexion, &c. their Manners, Cuſtoms, Employments, Marriages, Feaſts, Hunting, Computation, Language, *&c.*

With Remarkable *Occurrences* in the *South Sea*, and elſewhere.

By *LIONEL WAFER.*

Illuſtrated with ſeveral Copper-Plates.

*LONDON:*

Printed for James Knapton, at the *Crown* in St. *Paul*'s Church-yard, 1699.

FIG. 3. Title page of first edition of Wafer's *New Voyage*.

FIG. 4. A plate from Wafer's book.

and not missing any part. But the Arrows are gaged, so that they penetrate no further than we generally thrust our Lancets: And if by chance they hit a Vein which is full of Wind, and the Blood spurts out a little, they will leap and skip about, shewing many Antick Gestures, by way of rejoycing and triumph.

I was by while this was performing on *Lacenta*'s Lady: And, perceiving their Ignorance, told *Lacenta,* That if he pleased, I would shew him a better way, without putting the Patient to so much Torment. Let me see, says he; and at his Command, I bound up her Arm with a piece of Bark, and with my Lancet breathed a Vein: But this rash attempt had like to have cost me my Life. For *Lacenta* seeing the Blood issue out in a Stream, which us'd to come only drop by drop, got hold of his Lance, and swore by his Tooth, that if she did otherwise than well, he would have my Heart's Blood. I was not moved, but desired him to be patient, and I drew off about 12 Ounces, and bound up her Arm, and desired she might rest till the next Day: By which means the Fever abated, and she had not another Fit. This gained me so much Reputation, that *Lacenta* came to me, and before all his Attendents, bowed, and kiss'd my Hand. . . . Thus I was carried from Plantation to Plantation, and lived in great Splendor and Repute, administring both Physick and Phlebotomy to those that wanted.[15]

For three months Wafer lived quite pleasantly among the Cunas. His peregrinations in Darien and the esteem in which the people held him made it possible for Wafer to observe the natives, their customs and country intimately as no other foreigner had ever done. He described the Indians as handsome, chaste people with a sprinkling of albinos among their number. The social and physical aspects of the maturational process were told with detail and simplicity worthy of any modern-day investigator:

As the Children grow up, the Boys are bred to their Fathers Exercises; especially shooting with the Bow and Arrow, and throwing the Lance; at both of which they are very expert. I have seen Things perform'd by them with a Dexterity almost incredible: For Instance, a little Boy of about eight Years old, would set a Cane up on end, and going about twenty Paces from it, would split it with a Bow and Arrow, and not miss once in several Essays. This I have seen, and this is the chief of their Exercise: And as they generally accompany their Fathers on Hunting, (especially when about 10 or 12 years old, and big enough to carry their own Provision, and a Calabash of Corn-drink) so they will shoot little Birds they meet with, and strike in with the Hunt. Their young Children they never carry abroad with them on a Journey, or on a hunting or fighting Expedition. The Boys, when grown somewhat big, always go abroad with the Father and Mother, and do what little Services they can; but the Girls stay at home with the old Women.

They seem very fond of their Children, both Fathers and Mothers, and I have scarce seen them use any Severity towards them. And the Children are suffer'd to divert themselves which way they will. Swimming in the Rivers and catching Fish, is a great Exercise even for the small Boys and Girls; and the Parents also use that Refreshment. They go quite naked, both Boys and Girls, till the Age of Puberty; when the Girls put on their Clout, and the Boys the Funnel. . . .

[15] *Ibid.*, pp. 28-30.

The young Maids are shut up in private by their Parents at the time of Puberty, and will not be seen by any, but put a piece of Cotton as a Vail over their Faces, if any one should come accidentally into the Place where they are, tho' it be their Father. This Confinement lasts not long, but they soon go abroad again. . . .

When they marry, the Father of the Bride, or the next Man of Kin, keeps her privately in the same Apartment with himself the first seven Nights; whether to express an unwillingness to part with her, or for what other Reason I know not; and she is then deliver'd to her Husband.[16]

From Wafer's account of their customs and higher arts, one derives an impression of the Cunas as a simple society based on monogamy and the family unit. Their skill in the sciences was less highly developed than that of the Aztecs or Incas.

When any enquire the Way of them, as we had several times occasion to do in passing and repassing the *Isthmus,* their usual Method of informing them as to the Bearing of the *Place* they enquire after, is by pointing towards it; and as to the *Time* in which they may hope to arrive there, by pointing to some part of the Arc the Sun describes in their Hemisphere: For according as they point higher or lower either to the East or West of the Meridian, they suggest the time of the Day, Morning or Afternoon, in which you may hope to arrive at the River, Plantations, or whatever 'tis you enquire after. So the middle distance between the Eastern-Limb of the Horizon, and the Meridian, signifies 9 a Clock in the Morning; 4/6ths of the South-west Arc of the Suns Diurnal Course denotes 4 in the Afternoon, &c. If the Time they would intimate be not of Hours but Days, they turn their Faces Southward, and describing with their Hand the Arc of the Suns Diurnal Course from East to West, when they have brought their hand to point to the Western Horizon, they then bring it to the side of their Head; and laying down their Head on that side upon it, and shutting their Eyes, counterfeit for a moment their being asleep. Then repeating the Motion with their Hand, and the intervening sleeping times, they make you understand that there will be so many sleeping Times or Nights before you arrive at the Place you seek.

I observ'd among them no distinction of Weeks or particular Days; no parting the Day into Hours, or any Portions, otherwise than by this *Pointing:* And when they use this, or any other Sign, yet they speak at the same time, and express their Meaning in their own Language, tho' to *Europeans* who understand it not. They reckon Times past by no Revolutions of the Heavenly Bodies, but the Moons: For *Lacenta* speaking of the Havock the *Spaniards* had made to the Westward, intimated 'twas a great many Moons ago.

Their Computation is by Unites and Tens, and Scores, to an Hundred; beyond which I have not heard them reckon. To express a Number above this, they take a Lock of their Hair, little or great, (in proportion to the Number they would intimate) and hold it up in their Hands, sorting it gradually with their Fingers, and shaking it. To express a Thing innumerable, they take up all the Hair on one side of the Head, and shake it.[17]

By the end of August it was apparent to Wafer that he was indispensible to the Indians. If ever he hoped to leave, he had bet-

[16] *Ibid.,* pp. 158-163.
[17] *Ibid.,* pp. 177-180.

ter work toward the goal soon. He took the opportunity while hunting with Lacenta. Turning the conversation to the subject of hunting dogs, he praised the English breed and offered to bring back a few specimens if the chief would let him go to the northern coast. The request was granted only on the condition that Wafer return and then marry Lacenta's daughter. If the chief were sincere, this was perhaps the greatest tribute paid Wafer, for the Cunas were fiercely proud of the purity of their strain.

And so, with the help of guides, the five travelers made their way to La Sounds Key, where they saw some ships tied up.

> We went aboard the *English* Sloop, and our *Indian* Friends with us, and were received with a very hearty welcome. The four *English* Men with me were presently known and caress'd by the Ships Crew; but I sat a while cringing upon my Hams among the *Indians,* after their Fashion, painted as they were, and all naked but only about the Waist, and with my Nose-piece (of which more hereafter) hanging over my Mouth. I was willing to try if they would know me in this Disguise; and 'twas the better part of an Hour before one of the Crew, looking more narrowly upon me, cry'd out, Here's our Doctor; and immediately they all congratulated my Arrival among them.[18]

## Back to the Sea

A few days and they were ready for sea again—all save Gopson, who died shortly after the reunion. Wafer signed on with Captain Wright, with whom Dampier was also allied, but was transferred shortly to a French ship under Captain Yanky. At this point, again, Wafer's narrative suspends in deference to the senior author.

The ships careened about the Indies in company for a while until Wright and his crew elected to try life in Virginia. For the rest, raids in the Caribbean netted several prizes, including a Spanish ship. This ship was the cause of a further split in forces. At the Isle of Ash, John Cook, as quartermaster of Yanky's craft, became captain of the prize according to the tradition of the privateers. It was not long, however, before Yanky, Tristian, and others plundered their new fellow-command and set most of the English on shore under the pretext of their having no commissions. For some reason, Tristian took Captains Cook and Edward Davis, Lionel Wafer, and some others with him. His lack of perception was punished near Haiti. As the ship lay at anchor with most of the officers and men ashore, the English evicted the rest and immediately sailed back for the Isle of Ash. They took their former comrades

[18] *Ibid.*, pp. 41-42.

aboard, renamed Tristian's ship *Revenge,* and quickly captured a French merchantman and a ship suitable for piratical expeditions.

Peru and Chile seemed the richest targets for further attacks, but before they could be attempted, reinforcements were necessary. The Spanish and now the French were obviously against them; the English had replaced the buccaneer-protector Modyford with a sterner governor and with Sir Henry Morgan as his deputy. And none is so righteous as a reformed sinner.

The best plan seemed to be recruitment from the English Colonies in North America, where buccaneering was still tolerated. Accordingly, in April 1683 the *Revenge* sailed into Chesapeake Bay to pick up Dampier and any others game for excitement and plunder. The combined forces resolved on a voyage to the South Seas, and after the necessary preparation sailed under Captain Cook on 23 August, with Edward Davis as quartermaster, Ambrose Crowley, master navigator, William Dampier, "master's-mate," and Lionel Wafer, surgeon.

Their southward progress was interrupted at the Cape Verde Islands only long enough to replenish the stores with captured victuals and, farther down the coast, to capture a Danish ship and a smaller vessel. The larger was renamed *Batchelor's Delight* and thenceforth served in place of the *Revenge,* which was purposely burned.

After a landfall at the Falkland Islands on 28 January 1684, the buccaneers rounded the Cape in the face of terrible storms. They proceeded northward until they met Captain John Eaton in the *Nicholas* and then sailed in company to Juan Fernandez. Thirty-five years later Juan Fernandez was to be familiar to all England as the island home of Alexander Selkirk, Defoe's Robinson Crusoe. Much later still, medical historians were to remember it through Osler's story of Thomas Dover, physician on the ship that rescued Selkirk.[19]

But Wafer had his own Robinson Crusoe. While Watling was captain, in 1681, a sudden raid by the Spanish had compelled the buccaneers to leave their Mosquito Indian, William, when they hastily quitted Juan Fernandez. Three years later, in a paroxysm of generosity or curiosity, the buccaneers sought to find their Will. There he was! "He had a little House or Hut half a mile from the Sea, which was lined with Goats skin . . . He had no Cloaths left,

[19] Thomas Dover, M.B. (of Dover's Powder), physician and buccaneer. *Johns Hopk. Hosp. Bull.,* 1896, *7,* 1-6.

having worn out those he brought from *Watlin*'s Ship, but only a Skin about his Waste."[20]

While the *Batchelor's Delight* and *Nicholas* remained at Juan Fernandez, all the "scorbutick" men were put ashore and treated with herbs and meat by the four surgeons of Eaton's ship. In spite of what he had lived through, Wafer does not seem to have advanced very far professionally, for his position was still that of an assistant to the established four.

Northward to Lobos Island the pirates sailed, to the Gallapagos and Cocos. At Cape Blanco Cook died of illness contracted at Juan Fernandez and was replaced by Edward Davis. Raids of varying success followed, and the alliance with Eaton was exchanged for one with Captain Swan in the *Cygnet*. After capturing a few ships, the pirates left for the North again on 23 December.

Near Panama forces were joined with the English Captains Townley and Harris and the French Grogniet to make a force of 960 men. The company intercepted a packet telling of the arrival of the Spanish fleet at Porto Bello and requesting dispatch of the Plate fleet from Lima to Panama, so they now devoted themselves predominantly to waiting for the treasure ships. Unhappily for the buccaneers, when the fleet did arrive on 28 May 1685, some months later than expected, the fleet was aware of the pirates' presence and had unloaded its cargo elsewhere. It was now prepared for battle. The ensuing conflict effectively repulsed the pirates but resulted in no gain for either side.

At the rendezvous off the Keys of Coiba, Davis and Swan decided to abandon further sea attacks for the land. Their success in the terrestial medium at León was no better, and it seemed wisest for each commander to seek his own way. For Swan it was to be a cruise across the Pacific to the East Indies, for Davis a passage along the Peruvian coast. Dampier preferred the unknown; he joined Swan, and the companies parted on 25 August.

At the parting Wafer again takes up the account. He probably had more time to think about his adventures at that time, too. With Swan must have gone about half the cases of typhus with which the solitary surgeon had to contend.

The events of the next year were largely unremarkable. Wafer did, however, record some singular happenings at the Cocos Islands:

> . . . being minded to make themselves very merry, they went ashore and cut down a great many Coco-trees; from which they gather'd the Fruit, and drew about 20 Gallons of the Milk. Then they all sat down and drank

[20] Dampier (1698), p. 86.

Healths to the King, Queen, &c. They drank an excessive quantity; yet it did not end in Drunkenness: But however, that sort of Liquor had so chilled and benumb'd their Nerves, that they could neither go nor stand: Nor could they return on board the Ship, without the Help of those who had not been Partakers in the Frolick: Nor did they recover it under 4 or 5 Days time.[21]

To this day the explanation for the disturbed physiology of the crew of the *Batchelor's Delight* cannot be fathomed. Coconut milk has no known toxins, nor is its composition such that deranged fluid or electrolyte balance might be expected after drinking even a large quantity. The natives of Thailand, however, believe that coconut milk contains estrogenic substance.[22] If their folklore prove fact, there would be several interesting explanations for the extraordinary behavior of hardened sailors.

Putting to sea the *Batchelor's Delight* again rounded the Cape, stopped for a while at Montevideo, and continued to the Caribbean. There, as Wafer concludes his story, they met with Mr. Edwin Carter in a Barbadoes sloop.

. . . I and some others went aboard him, and had of him the News of King *James*'s Proclamation to pardon and call in the *Buccaniers*. So we went in his Ship to the River *de la Ware*, and up into *Pensilvania*, to the City of *Philadelphia;* where I arriv'd in *May*, 1688. There I stayed some time; after which I came down the River *de la Ware* as far as *Apokunnumy*-creek, with Capt. *Davis*, and *John Hingson* who was left with me on the *Isthmus:* There we carted our Chests, with other Goods, over a small Neck of Land into *Bohemia*-River, which leads down the great Bay of *Chisapeek* to Point-*Comfort* in *James*-River in *Virginia*. There I thought to settle: But meeting with some Troubles, after a three Years residence there, I came home for *England* in the Year, 1690.[23]

"Some troubles," indeed! The problems so casually dismissed amounted to almost two years' confinement to Jamestown and its jail. The colonial papers and the documents of Sir Hans Sloane showed what really happened.[24]

## A Prisoner in Virginia

Mr. Carter took Wafer, Captain Davis, and John Hingson, the same who had crossed the Isthmus, to Philadelphia. After a short stay the comrades decided to move across land to Point Comfort. They chose a very bad time for moving. The governor of Virginia,

21 *Ibid.*, pp. 193-194.

22 Eiseman, B. Department of Surgery, University of Colorado School of Medicine, personal communication.

23 Dampier (1698), pp. 223-224.

24 Wafer, *A new voyage and description of the Isthmus of America*, 1934, pp. xlii-l.

Lord Howard of Effingham, was deadly serious about bringing pirates to justice. Even more so was the Royal enforcement agent, Sir Robert Holmes, since he received a commission from every captured sea chest. It was an agent of Holmes who took the trio and their slave into custody on 22 June 1688.

Before the colonial authorities, Wafer styled himself Lionel Delawafer and told of having lived in the Indies for seven years and of having traded with the buccaneers without actually having been one himself. He admitted knowing Hingson, but Davis was allegedly a perfect stranger. As for the contents of his chest—silver plate, dishes, lace, broken cups, and Spanish money worth $1100—they were just the results of his trade with the Spanish. Hingson also pleaded innocence. The authorities, however, chose to believe the truthful allegation of the slave concerning his masters.

Once the three were in jail, lawyer Micaiah Perry showed them the fallacy of maintaining their innocence, but he was also able to remind them that they had given themselves up voluntarily to take advantage of James II's amnesty toward certain pirates. A suit was accordingly entered for restoration of goods. For Lionel Delawafer were claimed 1158 pieces of eight, 162 pounds of plate, 1½ ounces of gold, and silk and cloth worth £40.

The adventurers were ultimately given their freedom in Jamestown, but their property was still impounded. Not until June 1690 were they permitted to withdraw enough to pay their local debts and sail to seek Royal pardon. After eleven years abroad, Lionel Wafer was back in England.

In the petition to King William, the story of besmirched righteous intention was repeated. It was a small world, though, even in the seventeenth century. Both Lord Howard and Sir Robert Holmes were in England to detract from their pious declarations, but the state's case was otherwise weakened by the death of two chief witnesses. Matters dragged on in an indeterminate state until a Royal decision was pronounced in March of 1692. The settlement stipulated that all goods belonging to Wafer and his colleagues were to be restored with the exception of £300, which, together with one quarter of the amount still in Jamestown, was to be "applied to the building of a college in Virginia."[25] Thus Wafer acquires another title. Besides having been "the Livingstone of Central America,"[26] surgeon to the ship that rescued a Robinson Crusoe decades before Selkirk's deliverance, and historian of the

[25] *Ibid.*, pp. xlix-l.
[26] Foy, A forgotten medical worthy, p. 23.

buccaneers, Wafer was a founding father of the College of William and Mary.

## LAST ADVENTURES

One likes to think of Lionel Wafer peacefully devoting his remaining years in London to preparation of his *Voyage* and to philosophical reflections on comparative civilizations. Such was not to be. Next for the 32-year-old world traveler was an adventure with the Scots Darien Company.

William Patterson and Fletcher of Saltoun in 1695 founded a company for trading with Africa and the Indies under encouragement of an act of the Scottish parliament. Naturally they consulted the well-known navigator, Dampier, and from him received some knowledge of the Indies and an advance copy of Wafer's journal. In London, excited agitation greeted news of the Scots' enterprise. Wafer and Dampier were summoned to testify before the Lords of Trade and Plantation. Their testimony together with Wafer's "Secret Report" were undoubtedly factors in England's urging colonization of Golden Island and adjacent Darien.

As commercial rivalry steadily increased, Wafer himself became so valuable that the Scots Company thought it prudent to engage him for two years at £750 and to pay an additional 20 guineas to suppress publication of his book for a month. They were particularly interested in his aid in guiding an expedition to a forest of red dyewood shown the buccaneers by Lacenta.

In great secrecy, under the pseudonym of Mr. Brown, Wafer left London in 1698. Conferences near Edinburgh followed. The guileless surgeon told the merchants all the particulars of the location of the wood. Cocksure of their objective, the Scots felt no further need of their informant. Then, under the pretext that the Company might want to sail at any time, the entrepreneurs kept Wafer closeted in a dark garret for two days before releasing him with news that English warships in the harbor had thwarted their plans. Back to London the disappointed surgeon traveled, with only 20 guineas for consolation.[27]

The first edition of *A New Voyage and Description of the Isthmus of America* in 1699, dedicated to the Earl of Romney, made

[27] This is the version given by "Phil. Scot." (probably Walter Harris or Herries) in *A defence of the Scots abdicating Darien.* London, 1700, xvii, 168 pp. (pp. 38-43). The anonymous author of *An inquiry into the causes of the miscarriage of the Scots colony at Darien* (In *A collection of state tracts publish'd during the reign of King William III.* Vol. 3. London, J. Darby, 1707), pp. 557-559 denounced this account. He stated that the merchants found Wafer unhelpful, and, finding him so, felt it best to keep him in uncertainty.

no mention of the Scots' expedition, but undoubtedly the excitement of the venture spurred sales. The sensation caused by the nearly complete extermination of the first Darien colonists was certainly a factor in the call for a second edition in 1704. To this edition, dedicated to the Duke of Marlborough, were added the largely fictitious, "The Natural History of those Parts, By a Fellow of the Royal Society" and the story of another Isthmian crossing, "Davis's Expedition to the Gold Mines, in 1702." During Wafer's lifetime a translation into Dutch was published. Posthumous editions appeared in French (1706), German (1707), Swedish (1789), and Spanish (1888); in this century there have been the American edition of G. P. Winship in 1903 and the definitive Hakluyt Society edition of L. E. Elliott Joyce in 1934. Still, Wafer remains today "a forgotten medical worthy."[28]

No man knows whether Wafer ever touched lancet again after his return to England. No one knows his plans, his associates, his activities. Even the date of his death (1705) is an unsupported entry in the *Dictionary of National Biography*.

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# Some Aspects of the History of Anti-Pollution Legislation in England, 1819-1954

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A STUDY of nineteenth century trends in the British anti-pollution legislation is of minor importance within the framework of the history of Victorian England. If such a study is presented here, it is done for the following reasons. In analyzing the changing attitudes which ultimately led to tangible results in social legislation and economic policy, we gain a better understanding of the broader issues on which legislation against pollution was based. We also gain insight into the prevailing medical theories and are surprised to see how keenly aware some of the leading men were of the growing pains which necessarily accompanied the initial stages of an expanding industrial society. The reformers, the scientists, the public servants who testified before parliamentary committees and tried to educate the public so that legislative action could be taken lacked the knowledge of valid social theories. Yet their analysis of the unpleasant effects of urbanization on human lives contributed to the formulation of our modern theories.

This paper is limited to a comparison of the anti-pollution legislation of the nineteenth and twentieth centuries. This limitation in time does not imply that air pollution was the exclusive product of the nineteenth century. It had been noticed and objected to long before modern industry was established in England. At first the burning of coal in households in the thirteenth century had led to complaints. As manufacturing increased, these complaints became more and more frequent. But not until the nineteenth century did Parliament concern itself with the nuisances under which town dwellers and rural residents suffered when towns and industries developed rapidly after 1800. When dense black smoke from steam engines and factories and noxious vapors from the newly established chemical industries became unbearable, parliamentary commissions of inquiry were asked to examine the nuisances and suggest remedies for protective legislation.

The reports of the committees appointed to investigate smoke and its prevention illustrate the industrial history of England. They reflect a new attitude toward public health and indicate

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changes in the thinking on social and economic issues. These changes led to new administrative policies designed to combat the nuisances which had not been intensely disturbing in the preceding centuries.

This paper seeks to present an interpretative study of the British anti-pollution legislation as evidenced in parliamentary reports of the nineteenth century. It is hoped that in spite of its limited scope such a study will help to illustrate an aspect of public health legislation which has not been given more than passing consideration in the presentation of public health reforms.

## THE EARLIEST PARLIAMENTARY REPORTS ON AIR POLLUTION

When coal was used in open grates in the households of larger towns in the thirteenth century, complaints about smoke were voiced. By royal proclamation of 1306 artificers were not permitted to use coal, and by the seventeenth century smoke was recognized as a public nuisance in London. Its "dissipation" was discussed by Evelyn,[1] a onetime commissioner for the improvement of streets and buildings in London. Drastic action, however, was not taken until the nineteenth century.

At the time of the first parliamentary report on steam engines in 1819, England had just emerged from a period of spectacular growth. The owners of mills and warehouses and the speculators in land had accumulated great wealth. By 1816 the population numbered twelve million; it had almost doubled since the beginning of the eighteenth century. Many people had moved from the country to the centers of the new industrial development, and this movement did not take place in an orderly way. "Unregulated private enterprise had been covering the green fields with mile upon mile of squalid back to back cottages." The coal smoke of the multitude of steam engines spread layers of soot over the horizon; there was no authority to prevent nuisances. And there were thousands of people who lived underground in cellars described by contemporary observers as nurseries of diseases. In addition, the depressions of 1816 and 1819 made the need for reforms more urgent.

Not until 1828 would Edwin Chadwick publish his first article on "Life Assurances" in which he stated that it was the duty of the

[1] Sir John Evelyn, 1620-1706, held several positions after his return to England from France where he had stayed during the Civil War. He is less known for his efforts on behalf of the improvement of the streets of London than for his book *Sylva* in which he pleaded for the reforestation of England.

national government to provide for security from sickness and mortality. But even before then Parliament had been moved to action by complaints about the unpleasant conditions in the residential areas of the larger towns. Unclean air and dirt in the streets were annoying to the city dwellers. They gave cause for alarm, however, when air pollution and filth were suspected as a contributing factor in the rising death rate and the increased frequency of epidemic diseases. Under these circumstances Parliament appointed a commission to investigate whether perhaps the users of steam engines and furnaces might be compelled "to erect them in a manner less prejudicial to Public health and Public comfort."[2]

The Select Committee of Parliament published its findings in 1819 and 1820 when the "sanitary idea" was about to be born. Bentham's educational campaign had produced the critical spirit of investigation and the fanatic and relentless drive for remedial legislation. Advances in medicine proved that life could be saved by an unceasing fight against disease. And the new emphasis on the "right" to live in happiness and health directed the reforming zeal toward the improvement of external living conditions. Religious feelings added a further motivation for sanitation. Cleanliness, it was believed, would help the reception of religious impressions and feelings and the appreciation of the bounties of God.[3] Such a formidable combination of ideas could not fail to promote the movement for public health legislation.

Although the fight against smoke was only a minor aspect of the general attack on death and disease, the report of 1819—the first of its kind—reveals the complexity of the problem.

In reading the report[4] of the Select Committee appointed by Parliament in 1819 one is surprised to find that the members of the committee did not question the correctness of their basic assumptions. They seemed to be convinced that people had a right to be protected from the evil effects of smoke nuisances. After holding a number of hearings in 1819 the committee had requested additional time in 1820 in order to collect more evidence. The request was granted and in July 1820 the final report was submitted to Parliament. The members stated with satisfaction that they had had a full opportunity to ascertain the conclusions at which they

2 Report from the Select Committee on Steam Engines, Parliamentary Papers, 1819, VIII.

3 Hector Gavin, in *Unhealthiness of London*, lecture delivered to Health of Town Association, 1847, p. 66.

4 Report from the Select Committee on Steam Engines, 1819, VIII, Preface.

arrived. Compared with the reports of later decades, however, this one seems to be very brief.

The evidence was obtained by experts in the field, i.e., engineers, physicians, proprietors or users of steam engines, and a man who had served as commissioner of nuisances. Arranged in topical order, this is what they had to say. They agreed that the volume of smoke and the nuisance it caused had increased during the past thirty years. This increase was not measured scientifically. It was merely estimated, and the estimates were based on the memory of the witnesses. A building inspector, for instance, testified that twenty years earlier one could see the ships in the harbor of Liverpool from a nearby hill, whereas in 1819 chimneys hid the view of the harbor although the number of houses had not increased. Another witness stated that he had observed for many years how the smoke of London was hanging over the city in one continuous cloud. He estimated that his observations covered the last twenty years. Another one noticed that the flowers in his garden were blackened by smoke, whereas earlier he had been able to see them in their natural color. But even though these men could not give precise information on the increased volume of smoke, they could refer to the many complaints they had received between 1800 and 1819.[5]

Several smoke-consuming devices had been tried out since Drinkwater first established his mill for mule spinning in Manchester. Wakefield, an engineer who specialized in smoke prevention in Manchester, had tried to improve Bolton and Watt's engines in this respect in 1789 when he cooperated with the two inventors. But the improved method proposed by him required more coal and therefore his invention was not widely introduced. The cost of prevention, either in terms of coal or in terms of installation, remained a deterring factor during the entire period. Only pressure from nearby residents and constant complaints could overcome this obstacle.

Why, in this age of the gospel of wealth, did authorities pay any attention to complaints? Why, in this economy-minded age, did industrialists listen to requests for beauty and enjoyment of life in pure clear air when the growth and wealth of towns were symbolized by smoking chimneys? From the prominence which this report gives to the question of health, it seems that this was the overriding consideration. Physicians who testified were convinced that smoke

[5] *Ibid.*, and Report from Select Committee on Steam Engines, 1820, II.

was damaging to health. Their theoretical explanations for their statements were different, however. Dr. Roberts, a practising physician in Bloomsbury Square, believed that "air loaded with impurities" could not be respirable to the extent required for the health of the nation. Such air, he said, lost its elasticity and could not be properly ventilated.[6] This seems to have been a widely accepted theory. Another witness, not a physician but a surveyor of building defects, had stated earlier that coal furnaces were healthy, provided smoke could be prevented, because they stimulated air circulation which promoted health. According to Dr. Roberts' testimony, however, smoke did not "generate" disorders, but "vitiated" the pure air and thereby mechanically deprived it of the power of ventilation.[7] Apparently he meant that smoke-filled air was heavy and did not circulate. Since he admitted that the unwholesome atmosphere and its effect on the health of the people of London had worried him for many years, one is surprised to find that he did not make a more thorough investigation of the problem.

Another physician who practised in Soho Square expressed similar "beliefs." He had noticed that sick people recovered more quickly in fresh country air but did not specify the diseases from which they recovered in a rural environment. In the cities, he said, the salubrity of the air was diminished by the presence of carbonic acid and contamination stemming from many causes. Like Dr. Roberts, he did not think smoke-filled air germinated disease, but he did think that a disposition to asthma, for instance, was aggravated in an unhealthy atmosphere.

The committee members were pleased with the information gathered through evidence. They appreciated the fact that persons had volunteered information which might adversely affect their own interests. They were optimistic that the nuisance so generally complained of might either be "considerably diminished or altogether removed."

While the experts and reformers shared the confidence expressed in the report of 1819, they were unaware of the long and bitter fight they would have to wage against resistance to effective and universal legislation against air pollution. They overestimated the readiness, on the part of property owners, to vote for legislation whose implementation required financial sacrifices as well as regulations which they were not willing to accept in the interest of health and comfort.

[6] *Report*, 1819, VIII, p. 278.
[7] *Ibid.*

In the interval between the first and second air pollution reports of 1819-1820 and 1843 respectively, Chadwick had directed public attention to the outmodedness of the British poor laws. Although his investigations of 1832 and 1833 were primarily concerned with the social and economic problem of the poor-law administration, they focussed attention on a wider topic, namely, that it was man's duty to preserve life and not to waste it. The Poor Law Board with Chadwick as its secretary was set up in 1834. Under his energetic leadership the public was warned that the health of the poor was the concern of the rich as well and that mansion and cottage were bound to be affected by filth and disease in the slums. The science of sanitation was thus promoted and, since air pollution was held to be the concern of sanitation, it is not surprising that Parliament appointed an investigating committee in 1843.[8] Its task was broader than that of the earlier committee. In addition to inquiring into the best means of preventing the nuisance of smoke from fires and furnaces and its practicability, the committee was also to advise on legislation by which its recommendations could be carried out. The report of 1843 was longer than its predecessor. It contained 196 pages of evidence and two full pages of recommendations. It is obvious that the committee now treaded on firmer ground. It was of the opinion that smoke prevention was possible through the knowledge supplied by chemistry and medicine. The cost of smoke prevention to manufacturers, they thought, would not be excessive nor would prevention unduly interfere in the process of manufactures. But they added that the introduction of smoke-consuming mechanical devices might well interfere with the property or the interests of the manufacturers and proprietors of furnaces.[9] How different this note sounds from the one struck in the report of 1819-1820.

Some of the witnesses made an urgent plea for remedial action. If, they said, smoke had become so unbearable in 1843, how would it be in the future when as the result of the steadily expanding factories in England furnaces and steam engines were bound to aggravate the unpleasantness of the existing evil. Again, a note of optimism was voiced. They looked forward to "cordial aid and cooperation, on the part of the proprietors of factories, in accomplishing an object so essential to the comfort and well-being of the

[8] Report from the Select Committee on Smoke Prevention, Parliamentary Papers, 1843, VII.

[9] *Ibid.*, p. iii.

surrounding country and population."[10] They reminded the public that anti-pollution measures must be national in scope since they concerned the whole of England and consequently only legislation introduced by Parliament could cope with the problem.

Only two years later, in 1845, a third report was issued to supplement the report of 1843. Both reports contributed to the elucidation of the medical and social consequences of pollution. They also gave information on the feasibility of preventive measures and made it clear that prevention required cooperation by the owners of factories and engines, and the readiness of leading men in public affairs, public health, and medicine to introduce legislative controls.

In their reports of 1843 and 1845 the commissioners had noticed that local acts had not been very helpful in the control of nuisances. Sir Henry de la Beche and Dr. Lyon Playfair were therefore asked to report in 1846 on the causes of the inefficiency of local acts.[11] They found that local acts lacked preciseness and failed to define clearly what constituted a nuisance. The offender, in order to become subject to punishment, had to be caught in the act, i.e., the inspector had to prove that smoke was coming out of his furnace when he imposed the fine. The magistrates, themselves often financially interested in parishes or towns which they administered, hesitated to impose fines even after the offense had been established. It seemed that the administration of anti-pollution acts must be under the central government in order to be independent of local pressures.

This is precisely what the commissioners had in mind when they complained in their report of 1845 that the evil of air pollution continued and increased. They had concluded that the "provisions in local acts for preventing the escape of dense black [*sic*] from furnaces and steam engines in towns, be made general."[12] Local authorities seldom acted as long as the complainant had to prove the guilt of the manufacturer. Private individuals lacked the funds to start proceedings; often they were too lethargic to translate their indignation into action, however much they suffered from nuisances. It was imperative to invest local administrative bodies with

[10] *Ibid.* It is interesting to note that among the examiners and witnesses there were doctors of medicine and chemistry, engineers, factory owners. This indicates that the problem of smoke prevention was recognized as a joint problem of medicine, science, and technology.

[11] Report addressed to Viscount Canning by Sir Henry Thomas de la Beche and Dr. Lyon Playfair upon the means of obviating the evils arising from the smoke occasioned by factories and other works situated in large towns. *Parliamentary Papers*, 1846, XLIII.

[12] Second Report of the Commissioners of inquiry into the state of large towns and populous districts. *Parliamentary Papers*, 1845, XVIII, p. 45.

the legal powers necessary to start proceedings immediately after complaints had been substantiated by witnesses.

Another difficulty anticipated by the commissioners was this. To make the administration of anti-pollution measures effective, the industrialists and their employees must first be educated to cooperate. They must become convinced that minor restrictions of their freedom of action would in the end be profitable to them, too. In this respect the evidence of the 1843 report had indicated the nature of the difficulties. The Rev. Nassau Molesworth was asked by a member of the investigating commission whether the proprietors could be made to see that smoke prevention was in their interest.[13] His answer was pessimistic. He did not think that "there would ever be any general adoption of any plan, there is that indolence in human nature in remedying evil, and unwillingness to incur expense." When the reverend gentleman was reminded that perhaps the manufacturers would be less resistant to change if they knew that smoke prevention was not excessively expensive, he replied that there was an unwillingness to be convinced because they were only concerned with the immediate outlay, and the long-range advantages were too remote to be taken into consideration.[14] Another witness, a furnace architect and engineer with a more practical outlook, attributed the slackness of the manufacturers to the fact that many unsatisfactory devices had been put on the market which aroused their suspicion. Practical proof was needed to convince the manufacturers that smoke prevention would really save fuel.[15] Others attributed the lack of action on the part of the manufacturers to the fact that the personnel in the factories were too ignorant to cooperate in the control of excessive smoke.[16] And one observer was convinced that foreign competition forced the British manufacturers to count every shilling and that even the smallest additional expense was considered a hardship.[17] The few examples cited here are merely samples of many similar statements made by the witnesses in the hearings conducted in 1843. Although the investigating commissioners recommended immediate legislation to aid in the curtailment of smoke, the historian must come to the con-

[13] Notice the phrasing of the question by the investigator. He did not ask whether the proprietors could be compelled to introduce measures designed to prevent smoke. He merely asked whether they could be persuaded that such measures served their own interests. There was no intention as yet on the part of the government to interfere against the will of the owners of factories.

[14] Report from the Select Committee on Smoke Prevention, *Parliamentary Papers*, 1843, VII, p. 68.

[15] *Ibid.*, p. 24.

[16] *Ibid.*, p. 171.

[17] *Ibid.*, p. 5.

clusion that the time was not yet ripe for the introduction in Parliament of a bill to prevent smoke through compulsory and uniform measures.

It is not surprising, therefore, that the recommendations of the second parliamentary report of 1845 were limited in scope. The distinction which this report made between "opaque smoke," namely, the kind that caused annoyance, and ordinary smoke was so vague that it could be interpreted to anyone's liking. The report mentioned "some public Functionary or Functionaries" who were "to take cognizance of the Nuisance, and to bring Parties offending before the constituted Authorities within the locality in which the nuisance shall be proved to exist."[18] The evasive language of these recommendations indicates again that the burden of the proof was left in the hands of local officers. No drastic action was taken. No concrete proposals for nuisance control were contained in the reports of 1843 and 1845.

## The Evolution of Anti-pollution Legislation

For eighteen more years people in some areas of England lived in an atmosphere of smoke and poisonous fumes which according to prevailing medical views of the time affected health "not only immediately but indirectly, because wherever cleanliness of the person is discouraged there is always an increased tendency to disease. Filth in the person must tend to disease, more or less, and still more in the habitation."[19] By 1862 a new investigation was requested by Parliament. Noxious vapors from some factories destroyed animal life, and the health of the people began to be affected more directly. In order to ascertain the usefulness of the existing anti-pollution legislation a survey was made. The report of 1862[20] reflects the changes that had taken place in the British economic life since the beginning of the nineteenth century. No longer was the steam engine singled out as the principal offender, but the manufactures of soda and ammonia and the smelting of copper and lead were the main targets of complaints. It could not be denied that the effluvia from the chemical and metal industries were offensive. But it seemed legitimate to the commissioners to weigh the evil of pollution against the profit from the trade. Statistics showed that the alkali trade contributed £1,063,460 to the total income from trade

18 *Parliamentary Papers*, 1845, *loc. cit.*, p. iii.
19 *Parliamentary Papers*, 1843, *loc. cit.*, VII, p. 64.
20 Report from the Select Committee of the House of Lords on injury from noxious vapours, *Parliamentary Papers*, 1862, XIV.

in the United Kingdom.[21] During the decade 1852-1862 this trade doubled and employed 4,000 vessels in 1862 as against 2,000 vessels in 1852.[22] Under these conditions it was "obviously the duty of the Legislature to be very cautious in dealing with a trade which . . . [employed] so large a portion of the manufacturing industry of the country."[23]

The problem, then, was how to reconcile the requirements of national wealth with the needs of public health and comfort. The vapor was "pungent" and "perceptible in certain states of the atmosphere" at a distance of five or six miles, and its effect so "fearful" within a radius of one to two miles that something had to be done irrespective of the preferences of manufacturers. The experts agreed that the escape of noxious gases could be prevented. A number of producers of the alkali trade agreed that legislation should enforce the compulsory condensation of muriatic acid provided that the measure, while protecting the public, would not injure a "manufacture occupying so large an amount of capital and labour, so important to the prosperity of the country at large, and essential to the actual existence of large communities."[24]

While the 1862 report revealed the effect which the growth of the metal and chemical industries had on vegetable and animal life and how it contributed to the discomfort of the population that lived within the reach of the factories, it also stated another problem. The existing state of anti-pollution legislation in 1862 made remedial measures ineffective. The public could either put in a claim for damages where individual injury was alleged or, when the injury complained of was general and public, an indictment could be made. Individual action, as shown before, was too costly,[25] and indictment by local authorities did not lead to the removal of the nuisances. The manufacturers gladly paid a fine and continued as before because it cost them less than to introduce the required improvements. The verdict of guilty rendered the defendent liable only to appear in the Court of Queens Bench where fines were moderate. Moreover, since the laws against nuisances were not codified, it was difficult for the judges to convict the offender. In addition, the Nuisance Removal Act of 1856 gave inspectors of

21 *Ibid.*, p. 137.
22 *Ibid.*
23 *Ibid.*, p. iii.
24 Notice the care taken in order not to offend the financial interests of the industrialists.
25 See above, p. 481.

nuisances only limited rights of entrance to industrial premises between 9 a.m. and 6 p.m. Noxious gases could leave the chimneys of the factories unimpaired during the remainder of the 24-hour period. And, finally, the application of the Act was limited to cities, towns, or populous districts which left some manufacturers outside its jurisdiction. Since, moreover, the Act enabled defendents to take their cases to superior courts, local authorities might often find further prosecution too expensive.

But the report of 1862 did not dwell solely on the lack of codification of the laws against pollution. The witnesses differed widely in their opinions of the inspectors. One witness, a proprietor of alkali works, admitted that inspection was "more or less naturally repugnant" but he was nevertheless aware that inspection must be the essence of any measure designed to prevent pollution.[26] He was convinced that an inspectorship could be arranged which would not be detrimental to the industry. Another witness, a lawyer, found that inspectors were generally poor men with salaries of £80 to £100 per year and, though otherwise respectable, might not be trusted in their particular work.[27] An official of the Home Office characterized the inspectors as a rather low class, little better than serjeants of police.[28]

The major recommendations of the report of 1862 may be summarized as follows. Certain types of smoke prevention must be universal and nationwide. The inspectors should be given free access to every industrial establishment, and compliance with the laws should not be delayed by appeal to superior courts except in deserving cases. The commissioners believed that legislation based on their recommendations would not impose hardship on the chemical and manufacturing interests. But with due deference to local conditions they suggested that the choice of the device for smoke and nuisance protection should be left to the manufacturers.

The parliamentary reports which examined the existing state of anti-pollution legislation prior to 1870 had thus shown that air pollution was preventable. Evidence had also shown that the remedial measures were often resisted by manufacturers because of the anticipated economic sacrifices. Widespread fear had been expressed throughout this period that the administration of legislation against

[26] *Ibid.*, p. 193.
[27] *Ibid.*, p. 193.
[28] *Ibid.*, p. 218.

pollution would interfere with the freedom of action of nationally important industries.[29]

## THE 1954 REPORT ON AIR POLLUTION

The nineteenth century British reports on air pollution and the legislation enacted reveal the dilemma which the government faced. The need for coercive and uniform action was acknowledged. But the unwillingness to impose clean-air policies was deeply rooted in the nineteenth century theories on public administration and local government. It is illuminating to compare with the older reports a recent report issued in 1954 by the committee on air pollution in which very different views were expressed on a subject which was essentially the same as in the preceding century.[30] Its recommendations for remedial action are based on modern theories of government.

The nineteenth century reports reluctantly admitted that pollution was a nuisance which would ultimately affect the lives and habits of society as a whole. The twentieth century report starts from the assumption that pollution is a social evil. No proof was needed, so started the report, for the commission's "emphatic belief that air pollution on the scale with which we are familiar in this country today is a social and economic evil which should no longer be tolerated."[31] It also took for granted that a national effort to rid the country of pollution, though costly and sacrificial of necessity, was required. The report stated as self-evident that the government, local authorities, industry, and householders alike would have to pay the cost for the prevention of pollution.

While we noticed that in the nineteenth century reports the investigators were not sure just how damaging pollution was to the health of the people, the 1954 report expressed no doubt about its injurious effect on physical and mental health.[32] Remedial action

[23] In this context it is interesting to note that efforts to prevent air pollution were supplemented during the period 1868-1874 by a searching inquiry into the pollution of rivers. The pattern of the parliamentary reports during these years corresponds to that on air pollution.

[30] Committee on Air Pollution, Report, 1954, Cmd 9322.

[31] *Ibid.*, p. 6.

[32] The fact that more respiratory diseases and deaths occurred in urban centers was attributed to air pollution. The loss of sunlight due to the emission of smoke was another contributing factor to the death rate in cities. Lower resistance to infectious diseases and the extended time needed for recovery from disease were also attributed to polluted air. The report emphasized, however, that further research was needed to obtain more precise information. In this respect the report of 1954 went far beyond a statement made by a doctor in 1848. At that time William Kebbell, physician to the Brighton Dispensary, had merely stated that the breathing of unadulterated air was an essential condition for health and that "every degree of vitiation of it must . . . be subversive to health." See William Kebbel, *Popular lectures on the prevailing diseases of towns*, 1848.

and legislation were recommended at once in order to improve a condition which the report described as wholly bad "whether measured positively in relation to growth, well-being and joy of living, or more negatively in terms of death, disease, and the economic loss which goes with incapacity to work."[33]

The 1954 report made the startling assertion that air pollution cost the nation £250 million a year. This figure was arrived at by a careful estimate of the direct costs which included additional expenses for laundry, domestic cleaning, painting, repair of buildings, replacements of corroded materials, extra costs for transportation of coal, half of which went out of the chimney without proper combustion, additional lighting, extra medical expenses, and the like. The analysis of the economic loss through air pollution shows a complete departure from nineteenth century views. Formerly the primary concern of the commissioners was the cost which modest preventive measures would cause the manufacturers. No attempt was made in the early reports to analyze the loss of income incurred by pollution. The 1954 report takes it for granted that the nation must pay for protection at least a fraction of what is wasted by the continuation of a "social and economic evil of the first magnitude."

There is also an awareness in the recent report of the social problems created by pollution. Household consumers of smoke-producing fuels would not be easily persuaded to change over to coke if such a change would entail the abandonment of the traditional open-fire heating system. The change of appliances, however, and the production and sale of a suitable brand of coke would be the prerequisite of the introduction of smokeless zones. But the commissioners believed that the added joy of living in clean residential areas would be worth the sacrifice of forsaking tradition. The inclusion in a dry and factual report of an emotional factor, such as the joy of living, is a novel feature. The nineteenth century reports did not care how much or how little a person's happiness was affected by pollution.

The remedies proposed in the recent report can be classified under the following categories. The report outlines the techniques applicable at present for smoke prevention. It then describes the required legislation in order to maintain the suggested program. And it finally discusses the proposed administration of the entire plan. New techniques of smoke prevention will not be applicable without the simultaneous retraining of the personnel in factories

[33] Committee on Air Pollution, Report, 1954, Cmd 9322, p. 10.

and manufacturing establishments. Home consumers will have to submit to a certain measure of compulsion. The committee, therefore, believed that compulsion as well as financial aid were needed to change the habits of home consumers.[34]

Compulsion must be based on legislation. The Public Health Act of 1936 did not directly prohibit smoke, and the use of by-laws by local authorities did not lead to the satisfactory prosecution of all the violators. Therefore the committee recommended a new "clean Air Act repealing all previous legislation. This Act, enforceable on a nationwide basis, would prohibit dark smoke, regulate grit and dust, prescribe the design of new furnaces, and introduce smokeless zones and smoke-control areas.

The administration of the new law would be placed in the hands of a "Clean Air Council" with far-reaching powers to coordinate all aspects of smoke prevention. Its activities would also include the continuous propaganda of the new program, the education of the public and the submission to Parliament of annual progress reports. And finally, mention is made in the report of new and better trained inspectors without whose help the best piece of legislation would remain a dead letter.

The study of the reports of the nineteenth and twentieth centuries permits the following conclusions: (i) the problem of pollution, at first merely considered as a minor irritation, assumed steadily growing proportions until, in the twentieth century, it was designated as a major evil of modern civilization; (ii) the means of combatting the evil led to the introduction of new activities by government officials which were placed under the control of the central government; (iii) the added powers of the national government led to a reassertion of the powers of local authorities; (iv) new concepts of government developed in the course of the fight for clean air. The staunch defenders of freedom to breathe whatever air one wanted to inhale had to yield to those who enlisted the help of the national government for the protection of a more "joyful" life; (v) the evolution from the nineteenth century unwillingness to have government inspectors supervise anti-pollution measures to the twentieth century's nonchalant suggestion of a Clean Air Council reflects fundamental changes of attitude. In the nineteenth century the reports were written with an eye to the manufacturers, and improvements were suggested in an apologetic way. In the twentieth century the committee in charge of the report was primarily

[34] *Ibid.*, p. 25.

concerned with the health and welfare of the people. And finally, medicine and public health had progressed sufficiently by the end of the nineteenth century to lend active support to the fight against air pollution. The reports on pollution and its prevention are a valuable aid in the analysis of the changes which transformed the Victorian age and led to the development of the new social concepts of the twentieth century.

# Theobald Smith, Student of Disease (1859-1934)

PAUL FRANKLIN CLARK*

WHY, in the more than twenty years since the death of Theobald Smith, has no definitive biography appeared of this man who has been acclaimed one of the greatest figures in American medicine and certainly the most distinguished of the early American bacteriologists? Following his death in 1934, more than two dozen biographical sketches appeared in the lay and scientific press in this country and in Europe. These varied in length from a full column in the *New York Times*[1] to a two-page appreciation in the *Presse Médicale*[2] by the parasitologist Mesnil, who stressed Smith's fundamental work in Texas fever, an especially fine sketch of 14 pages written by William Bulloch of London Hospital and published in the *British Journal of Pathology and Bacteriology*,[3] to the best one of all, the critical memoir of 27 pages plus a bibliography of Smith prepared by Hans Zinsser[4] for the recently deceased member of our National Academy of Sciences.

Preston Kyes,[5] distinguished Chicago University anatomist and pathologist, calls Theobald Smith "the most notable figure in American medicine of his period." A number of others make similar statements.

William Bulloch,[3] author of the best critical history of bacteriology in the English language, states: "He was admittedly the greatest bacteriologist produced by the United States of America. For fifty years, his work was continuous and meritorious. His numerous discoveries, many of them of a fundamental nature, entitle him to rank alongside the greatest masters of bacteriology." And a comment in a letter of Eugene Opie[6] is especially pertinent.

> He is certainly the most outstanding of the medical scientists of this country but did not get the stamp of recognition that he deserved. He was interested in things and ideas and much less in people and his relations with them. He inspired respect rather than formal admiration. He was utterly lacking in ostentation. On one occasion he told me that chance had had a great part in his career. He would not wish to live his life over, he said, because he might not be so fortunate as to get again the opportunities he had had. In this opinion he was doubtless wrong and with some deviation, would have found the opportunities he needed.

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One could go on culling from the many essays, but I shall cite only one more quotation—this from Zinsser.[4]

> To the younger bacteriologists whose lives overlapped his own, Theobald Smith was a hero to be emulated and whose approval was a mark of distinction. He illustrated to them the dignity of austere devotion to scholarship and the modesty of wisdom. But always they stood in awe of him. He and Welch, were the two greatest individual influences that helped to hold the younger men working in the medical laboratories steadfast in the faith of the worthiness of honest effort. But Welch was loved instinctively for the warmth of his heart and for the urbane benevolence with which he encouraged younger men and commended them beyond their deserts. Of Theobald Smith, they thought as the dispassionate critical mind by which they were impersonally, though justly, appraised.

## Biographical Sketch

Theobald Smith was born in Albany, New York, on 31 July 1859. His parents were Germans who married in 1854 and came to this country that same year, embarking from Antwerp in a sailing vessel that took eight weeks for the voyage. They landed at the height of a cholera outbreak but escaped the disease and went to Albany where a relative had previously settled. The mother was Theresa Kexel, whose forebears had been principally school teachers. The father, Philip Schmidt (changed in this country very promptly to Smith) had been apprenticed to a tailor at the age of 14; he subsequently established his own small tailoring shop in Albany.

On graduation from the Albany public schools at eighteen, the son won a state scholarship to Cornell University by competitive examination. Following four highly successful college years, with emphasis on biology and on mathematics, Smith entered Albany Medical School in 1881 and during the two-year course for the medical degree he spent one spring semester in the biological laboratory at Johns Hopkins. Realizing that he was unprepared to practise medicine, and not relishing the restrictions of an apprenticeship in a country practice, he returned to Cornell for graduate work in biology with Professor Gage, his most valued teacher and life-long friend.

Smith's active professional life divides itself readily into three periods, each with a different geographical center and differing types of opportunity and responsibilities. Almost immediately following his return to Cornell came the chance to work with Daniel E. Salmon, Chief of the Bureau of Animal Industry at Washington, so at the age of 25 Smith began his career as Director of the Path-

ological Laboratory of the U.S.B.A.I. He continued in this position for 11 of his most productive years. While in Washington he married (17 May 1888) Lilian Hillyer Egleston; a happy family life gave him the necessary encouragement for his long hours of arduous work. In due time, three children were born to them: Dorothea Egleston, Lilian Hillyer (later Mrs. Robert R. Foerster), and Philip Hillyer.

In 1895, Smith was called to Harvard where he became the first George Fabyan Professor of Comparative Pathology. He was also appointed director of the Antitoxin Laboratory of the Massachusetts State Board of Health.

In 1915 he again changed his status and geographical location when he became Director of the newly constituted Department of Animal Diseases of the Rockefeller Institute at Princeton, New Jersey. (Interesting is the fact that in 1901 Smith had declined the Directorship of the projected new Rockefeller Institute for Medical Research, giving as some of his reasons his appreciation of the opportunities at Harvard, his dislike for large-scale administration, and his preference for the individual approach to problems. In a letter to Professor Simon H. Gage he remarks: ". . . You and I know that research cannot be forced very much. There is always danger of too much foliage and too little fruit.") He was officially retired in 1929 at the biblical age limit of three score years and ten but continued his studies until his death at the age of 75 in 1934. Fortunately, he was able to summarize his years of study of disease wherever he found it in many species including man. His clear-visioned, philosophical review *Parasitism and Disease*[7] merits frequent rereading.

Smith's most notable achievement was the demonstration with Kilborne, Curtice and others that Texas cattle fever is caused by a protozoan parasite that invades and destroys the red blood cells and that this parasite is spread by a cattle tick, the parasite passing through the eggs of the tick to the progeny and thence after a series of molts to the next cow.

Probably the contribution of next importance was the proof, against the weight of Robert Koch's authority, that the bovine and human tubercle bacilli are rather stable types, differing both in a number of cultural characteristics and more importantly in pathogenicity for man and other animals.

Other important subjects studied by Smith, often with the assistance of others, include: enterohepatitis or blackhead of turkeys, comprehensive studies of other diseases of lower animals such

as hog cholera and swine plague, the production of active artificial immunity by the injection of heat-killed organisms, the transmission of antibodies *in utero* and through colostrum, important differentiation of flagellar and somatic antigens, the first production of experimental scurvy, the use of slightly unbalanced mixtures of toxin-antitoxin for active immunization in diphtheria, and a wide number of ingenious methods for studying bacteria in the laboratory, including the universally employed fermentation tube.

Altogether, he wrote an overwhelming number (more than 250) of specific and general papers varying in length from a few pages to the classical monograph of 301 pages on Texas cattle fever. Twenty of his papers were written in German and published in German journals. Of these, I have consulted about 200 in some detail. I have had the benefit of letters from a number of Theobald Smith's close associates and also enriching conferences with Philip Smith, his only son.[8]

Now an attempt will be made to clothe this skeleton outline. Reviewing his life and his major studies, we shall endeavor to create a picture of Theobald Smith the man, how he managed his time, how he chose his problems, how he handled the affairs of the various laboratories with which he was associated, and how he worked both by himself and with his colleagues.

## The 1880 Period in Bacteriology

When Smith went to Washington in 1884, he knew no bacteriology, little pathology, and essentially nothing of the infectious diseases of domestic animals, a field in which he immediately plunged and in which, within a very few years, he was to make outstanding contributions. I shall give briefly the stages of development of this period in microbiology. Shortly before, following investigations of Davaine (1850), Pollender (1855), and others, Koch (1877) had for the first time demonstrated a causal relation between a bacterium and an important disease of lower animals and of man. He had reproduced anthrax in experimental animals by injecting pure cultures of *B. anthracis* and had recovered pure cultures of the organism from typical edematous lesions and the spleen. With less completeness, the causative agent of gonorrhea had been demonstrated in 1879, that of lobar pneumonia in 1880, typhoid fever (1880-1884), tuberculosis (1882), diphtheria (1884), and in the next few years a dozen others, a veritable whirlwind of discovery. Methods of cultivating bacteria in pure culture, stain-

ing these organisms, and studying their individual characteristics were being developed rapidly. In 1881 Pasteur in a dramatic and fortunate experiment at Pouilly-le-Fort had shown successful resistance to the injection of fully virulent cultures of *B. anthracis* in a group of 24 sheep, 1 goat, and 6 cows. This protection had followed a series of injections of attenuated organisms. Of the test animals all but one survived, while of an equal number of control animals all died of anthrax. Artificial vaccination, which had hitherto been thought peculiar to smallpox, immediately assumed broad general biological possibilities. The earlier troubles over the *Origin of Species* (1859) were almost forgotten in the excitement of hoped-for control of disease.

As a result of this intellectual ferment, beginning courses in bacteriology were sprouting up everywhere in this country; as, for example, a series of lectures by Sedgwick in 1884 at Massachusetts Institute of Technology, a course by Birge in 1885 at the University of Wisconsin, and the first course in any medical school in this country in 1885 by Ernst at Harvard. The first textbook in bacteriology in this country was, I believe, a translation by George Sternberg[9] in 1880 of Antoine Magnin's French text of 1878. It was in this "golden age, the romantic age of discovery in medicine," to use Dr. Welch's expression, that the young Smith began his work in a miserably equipped attic laboratory, insufferably hot in summer, with a jewel of a factotum, Alexander,[8] under the general direction of the chief of the Bureau, Daniel E. Salmon, Doctor of Veterinary Medicine.

We can imagine only with difficulty the excitement of the period and the pioneer spirit that prevailed. To the man on the street biologists were no longer harmless scientists but were to be honored and even feared. Much as the physicist and chemist of today have revolutionized our thinking and our world by terrifying control over atomic forces, so the microbiologists began to transform the thinking and modes of life of the western world during the latter half of the Victorian era. It was a major crusade with men joining in from widely different fields. Young Smith was one of these crusaders, although he was long and lank and lean and far removed in spirit and emotions from Peter the Hermit.

Smith was fortunate in reading and speaking German almost as well as English; he also read French easily. While he was exchange Professor at Berlin from Harvard, he gave all his lectures in German. He kept a personal diary (from 1874 to 1883) using English, French, and German more or less interchangeably.[8] So although

he was unable to sit immediately at the feet of the European masters, as many of his wealthier contemporaries did, he did learn only slightly less directly by constant reading of the voluminous German and French scientific literature.

## Major Contributions

### *Tuberculosis*

Smith's first independent paper (1884) was on tuberculosis,[10] and his productive interest in this disease continued throughout his life. The year before he died he gave the Thayer lectures[11] at John Hopkins Medical School, presenting a broad appreciation of the many problems in tuberculosis with emphasis both on the variations in the parasites and the variations in the cellular and humoral reactions in different host species.

The series of some 30 papers on this disease by Smith and his several associates exhibits an outstanding quality of the man, namely, his sticking to a problem even though interrupted by other pressing duties. In this instance nine years elapsed between his first two papers on tuberculosis and the third; in the interim appeared his significant papers on hog cholera and the now classical contributions which unravelled much of the confusion of Texas cattle fever.

In 1894, after giving definite recognition to Cooper Curtice, F. L. Kilborne and E. C. Schroeder[12] for their parts in the study, Smith records tests of the recently introduced tuberculin reaction in a herd of 60 cattle, with careful clinical, pathological, and bacteriological examinations. The almost overwhelmingly detailed histories of each cow and the subsequent guinea pig and bacteriological studies provide a typical example (178 pages) of the thorough, step-by-step, painstaking methods which Smith showed throughout his life. As one of the final statements in this paper, he approves the tuberculin test in cattle as *good* but *not perfect*. In a later review paper before the Harvey Society[13] (1906) in which he reports autopsies on 350 cattle with positive tuberculin tests, he expressed his consternation at finding so large a percentage of our milk cattle tuberculin-positive.

In 1896[14] and again in 1898[15] came papers, at first tentative and later more assured, on differences in virulence in tubercle bacilli from several sources. Quoting from his 1898 paper:

> The absolute identity of tubercle bacilli infecting mammals has been so generally assumed and the assumption used as a basis for the enactment of sanitary measures, having for their object the prevention of any transmis-

sion of the tubercle bacilli from animals to man, that any one who would attempt to question this identity must be prepared to meet considerable scepticism.

Tubercle bacilli which Smith isolated from the udder or other affected organs of tuberculous cattle and cultivated on artificial media were definitely more pathogenic for rabbits and cattle than were organisms isolated from human sputum or post mortem from affected human lungs. For example, an appropriate measured dose of the bovine strains injected into the ear vein of rabbits commonly produced death in 17-20 days, while a similar dose of strains from human sputa caused only a slowly progressive infection, often with a gain in body weight. The gross and microscopic examination of the organs at autopsy confirmed the differences.

We give a tabular summary of other characteristics correlated with this difference in virulence, which became apparent as the result of the piling up of evidence based on years of injections of experimental animals with meticulous postmortem studies on each animal.

TUBERCLE BACILLI

| *Characteristics* | *From bovine source* | *From human lung lesions* |
|---|---|---|
| Virulence | Not only were the "bovine types" more virulent for rabbits, but even with the highly susceptible animals, the guinea pig, subcutaneous (instead of intraperitoneal) injections of small doses showed more invasive progression | Less virulent, less invasive |
| Growth on artificial media, especially coagulated blood serum | Definitely slower. More membranous growth | More rapid abundant growth commonly with heaped up masses not readily broken up |
| Reaction curve of growth in glycerine broth | Original reaction becomes basic to phenolphthalein | Does not become alkaline |

Manifestly not all of his cultures fell into such clear-cut categories. Smith was again impressed as he had been in his hog cholera studies with variations among organisms from similar sources. He continued to stress variation in microorganisms throughout his life, long before dissociation and mutations became a part of our daily microbiological conceptions.

Smith's papers also present abundant evidence that not all tubercle bacilli even from primary tuberculosis of the mesenteric glands in children are bovine in type. In a 1905 paper[16] he reports the recovery of a bovine type organism from human case XI and a distinctly human type from human case XII.

As to the importance of bovine tuberculosis in human disease, Smith, with E. C. Schroeder,[17] had shown back in 1893 that certain tuberculin-positive cattle without obvious signs of tuberculosis of the udder did shed tubercle bacilli in the milk. In a review of this subject nine years later (1902)[18] he concluded that

> 1. There is no evidence to show that bovine tubercle bacilli may indiscriminately infect the human subject. A few bacilli are harmless but the flooding of the digestive tract with bacilli from tuberculous udders is dangerous.
> 2. There is some evidence that bovine bacilli have been isolated from human beings, that the successful transfer is uncommon and that it depends on certain conditions that need careful clinical and pathological study.
> 3. The evidence that transmission takes place must be based on the isolation of tubercle bacilli having the characters of the bovine variety.

The clash of opinion with reference to types of mammalian tubercle bacilli gradually weakened as the evidence from many different cases came in from laboratories in several countries. In 1901, at the International Congress on Tuberculosis in London, Koch startled his audience by reversing his earlier position, stating that the bovine tubercle bacilli were sharply different from the human. He based this change, he stated, largely on his experiments with his co-worker Schütz, showing that tubercle bacilli from human cases did not cause progressive tuberculosis in cattle. He gave no credit to the earlier and much more complete studies of Smith! By 1908 at the International Congress on Tuberculosis in Washington,[19] Smith was able to say that "The designation *human* and *bovine* which I applied tentatively to these types in 1898 has been generally accepted." With minor modifications our present position agrees with his.

Smith's absorbing interest in bovine tuberculosis and its relations to human disease led him to amplify (1898, 1899) the work of Sternberg (1887), Yersin (1888), and others in determining the thermal death point of tubercle bacilli in milk and other media. His conclusions which are especially important in the pasteurization[20] of milk run as follows:

> 1. Tubercle bacilli when suspended in distilled water, normal salt solution, bouillon and milk are destroyed at 60°C. in 15-20 minutes. The larger number are destroyed in 5 to 10 minutes.

2. When tubercle bacilli are suspended in milk, the pellicle that forms during the exposure at 60°C. may contain living bacilli after 60 minutes.

Yet another phase of Smith's work in tuberculosis ties in with his interest in active immunity and also with the work of Koch, Behring, *et al.* who recommended and used for a while certain strains of human type bacilli for the vaccination of calves. Experiments reported by Smith in 1911[21] showed "that not every strain of tubercle bacilli, clearly belonging to the human type, is adapted for the vaccination of calves against tuberculosis under ordinary conditions." Strain XXIV, for example, below rather than above the average virulence of human type for rabbits was fatal for four of nine calves on first injection. In a later paper (1915 with Marshall Fabyan) the authors[22] cite a number of cases from the literature, as well as their own, in which the injections of human type tubercle bacilli into calves "may in rare cases lead to subsequent shedding of such bacilli in the milk." "Bacilli lodging in the undeveloped udder, appear to be less promptly destroyed there than in other organs and tissues." "The hazard unless the treated herd is inspected by a competent person or unless the milk is pasteurized seems to make the procedure impractical."

I mention this active immunizing phase of Smith's tuberculosis work chiefly because in his pursuit of it one observes his extensive experience with many herds of cattle and his abiding concern with natural and acquired resistance to tuberculosis. Several of his papers of this period from 1910 to 1917 present some of the best of his pathological-physiological observations and thinking. And his presidential address[23] before the Twenty-Second Annual Meeting of the National Tuberculosis Association in 1926 is a gem as regards the primary resistance of the host and what is going on inside the tubercle.

In weighing the more unusual portion of the contributions of Smith in the field of tuberculosis, namely, the differentiation of human and bovine types, how much does he stand alone and how much did he derive from others? In his two earlier papers (1896, 1898) he refers to a number of authors who had been injecting tuberculous material and pure cultures into experimental animals. Especially he names Arloing of Lyons who had published a monograph in 1892[24] and states that the sources of Arloing's organisms are not well established.

The portion on tuberculosis presents an interesting account of the clash in the *Académie de Médecine* over the excellent studies of

Villemin. The report of the committee, chiefly of M. Colin, the chairman, their experiments and conclusions, are given in some detail. M. Colin was obviously biased, refused to see the results of his own experiments, and left Villemin to fight his own battles. He also included a history of the work of several French workers in the field, that of Koch, studies by Arloing particularly with avian material, and several experiments on immunization.

Arloing's own experiments are devoted especially to the study of avian tuberculous material injected into the common laboratory animals, guinea pigs and rabbits. He recognizes variation in all the organisms, both mammalian and avian, and observes changes in virulence after passages in animals of different species. He observes the different susceptibility of guinea pigs and rabbits when injected with tuberculous material or organisms from the same source but does not tie this up with any differentiation between bovine and human type organisms.

Arloing considered the avian tubercle bacillus a different type of the same species rather than a totally different species, as did Koch at this time. In a later review[25] Arloing states that his early work had been devoted chiefly to distinguishing between the avian and mammalian tubercle bacilli. He gives Smith the credit (p. 31) for differentiating the bovine from the human types *"plus près de nous."*

One must bear in mind, however, that the infectivity of the tubercle had been demonstrated by the French military surgeon Jean Antoine Villemin in a series of startling papers published between 1865-1869 and presented in a book of over 600 pages, *Études de la Tuberculose* in 1868.[26] Even in his first communication (1865)[27] Villemin stated that:

1. Tuberculosis is a specific affection.
2. The cause lives in an inoculable agent.
3. Inoculation is readily made from man to the rabbit.
4. Tuberculosis belongs then to the class of virulent disease, and should take its place in classification besides syphilis but more closely to the disease of glanders.

Later, he reported that bovine tuberculous material was more virulent for rabbits than human tubercles. A quotation from page 538 of Villemin's *Études* will strengthen these statements. "We have observed that none of the rabbits inoculated with human tubercles exhibited a tuberculous process as rapid and completely generalized as that which we have obtained by inoculation of tubercles from the cow."

These discoveries were soon confirmed and extended by many investigators, notably by Cohnheim and Salomonsen (1878) and by Hansell (1879). These studies formed the base on which both Koch and Theobald Smith built.

Smith does not mention the work of Villemin, although he certainly knew of it since the beginning sentence of Koch's first article on the tubercle bacillus (1882) refers to the demonstration by Villemin that tuberculous tissues inoculated into experimental animals will reproduce the disease. Koch, however, gave no specific references to this fact either in his 1882 or more complete 1884 paper. Something of the commotion that Villemin's "heretical findings," produced can be learned from the fact that he was asked to withdraw from the French Academy because of his radical views on the transmission of tuberculosis, and by the fact that although he continued to experiment and publish, he was not sufficiently recognized to receive a death notice (6 Oct. 1892) in the Paris medical weekly, the *Presse Médicale*. The quality of his work has now been fully recognized; in fact it was referred to favorably in this country in the formerly well-known textbook, Flint's *Practice of Medicine*, as early as the third edition published in 1868.[28]

We must, then, accord credit to Villemin not only for the transmission of tuberculosis to experimental animals of many species, but also for the recognition of the greater virulence of the bovine tubercle for rabbits. To Theobald Smith belongs the honor for demonstrating that pure cultures of tubercle bacilli from mammalian sources are of two different types, both as to virulence and certain cultural characteristics.

*Plagues of Hogs*

When D. E. Salmon was called to the Division of Animal Industry in 1879 (in 1884, this became the Bureau of Animal Industry and Salmon was made "chief"), diseases of domestic animals were causing uncounted losses, dire disaster to farming communities, and general fear that these little understood diseases would spread to man. Hog cholera was, and still is, one of the greatest menaces with which the livestock industry has to contend. So when young Smith in 1884 came to be Director of the Pathological Laboratory of the Bureau, he was promptly assigned to work with his chief on the rapidly fatal epizootics of hogs. Such a difficult tangle he found! As a matter of fact he never did succeed in unravelling the snarl. In that respect he joined a goodly company—Pasteur, Metchnikoff, Schütz and others, even Koch, as far as he entered into

the problem. I shall merely indicate some of the quandaries rather than the halting progress of the work; it was more than a dilemma, it was a trilemma in which and around which Smith continued to work as occasion presented during most of his life. Actually, there were at least three diseases that were being studied in different lands with nine or ten confusing names in the three languages most used at the time. Furthermore bacteriology was still a primitive science. Salmon, Smith, and Kilborne, and later Smith with V. A. Moore and associates, published extensively—hundreds of pages—in the annual reports of the Department of Agriculture, in special Bulletins, and in American and in German journals. Reading of these pages reveals the meticulous scrutiny each case and autopsy received and increases the admiration of the reader for the Bureau of Animal Industry and its chief pathologist.

The three diseases, with their common English names, are hog cholera, swine plague, and swine erysipelas. The names of these diseases, the clinical pictures, causative agents, and the investigators were all well mixed. These elements in the story plus human nature gave basis for name calling both across the Atlantic and in the United States. I have found in all Smith's papers only two instances (in the work of hog cholera and on Texas fever) in which he says anything much less restrained than "I cannot agree with the findings of Doctor X." But in the case of one Dr. F. S. Billings he did let go a bit. After reading some of Billings' experiments, without controls, I marvel at Smith's self-control. Commenting in 1886 on Billings and his papers, Smith says, "Dr. F. S. Billings seems to have aroused much attention chiefly because of the polemical attitude which he has assumed and the peculiar manner in which he has criticized the work of the Bureau of Animal Industry." "It is highly probable that Billings had under observation now one germ, now another and occasionally a mixture of both."

The study of these outbreaks gradually led to an understanding of the three diseases (in this country at that time only two—hog cholera and swine plague). In 1885, Salmon and Smith[29] isolated and described a motile, gram-negative, easily cultivable bacillus from a number of cases of hog cholera and reproduced what they thought was the disease by feeding the organisms to hogs. Their experimental animals showed parenchymatous degeneration of the viscera, some focal necroses in the liver, and inflammation of the intestinal mucosa, chiefly in the colon, just as had been the case with the sick animals in the field, and the organism was recovered from the experimental animals at autopsy. It was therefore called the

hog cholera bacillus or *Bacillus cholerae suis* (now *Salmonella cholerae suis*.)

Frequently, however, and in some outbreaks commonly, they found another bacterium, a very small, bipolar staining nonmotile rod which they isolated readily from the blood, the spleen, and from pneumonic areas in the lungs, as well from the intestines. This organism had been previously described by Löffler, and further experiments made it apparent that this was a member of the hemorrhagic septicemia group, and the cause of a pneumo-enteritis, swine plague, or the *Schweineseuche* of the German literature. The two diseases run together; sometimes one, sometimes the other is the primary infection. The two bacteria are, however, readily differentiated in the laboratory even though the two diseases have been so confusing. Indeed, the confusion in hog cholera was not cleared up until 1903 when de Schweinitz and Dorset[30] successfully transmitted a disease indistinguishable from hog cholera by means of bacteria-free filtrates of diseased animals. They completed their proof by finding that serum from animals that had recovered from hog cholera would neutralize the virus, rendering it harmless when injected into susceptible hogs. The "hog cholera bacillus" proved to be merely a pathogenic secondary invader.

How then shall we estimate the value of the studies of Smith and his associates in these hog epizootics?

They added to our knowledge of the large and confusing group of bacteria now named Salmonella in honor of Dr. Salmon.

They aided in differentiating swine plague from hog cholera.

We certainly cannot think harshly of anyone in this early period for failing to study a possible filterable virus, for these parasites were unknown until after 1892 when the mosaic disease of tobacco was produced in susceptible plants with the bacteria-free filtrates of leaves from the diseased plants. It was at least another decade before any considerable attention was given to viruses and half a century before viruses became a common household term.

The use of specific antigen-antibody reactions for establishing causal relationships between a given microbe and a particular disease was also not used until later. Grüber and Durham presented a thorough study of the specific agglutination reaction in 1896; other methods followed soon after.

There are several excellent instances of serendipity[31] in these studies of the Salmonella group and should be considered in rendering judgment. The first was by Salmon and Smith in 1886; they found that artificial immunity could be incited against these "hog cholera" bacilli by several injections of heat-killed organisms. Similar procedures have been used rather widely both in veterinary and in human medicine, notably in the preparation of antityphoid vaccines.

Smith and Reagh (1903)[32] were, I believe, the first to demonstrate the essential antigenic differences between the bodies of bacteria and the fla-

gella. This gave further evidence of variations in bacteria, motile and nonmotile strains of the typhosus bacillus, for example, and has altered materially both understanding and practices in bacteriology. There are a large number of named species in the Salmonella genus, the number having now reached about 150. There are also many types of pneumococci and streptococci based on different but comparable subtle differences in antigenic structure.

*Texas Cattle Fever*

It may be true, as most medical historians assert, that his four-year detective search resulting in solution of the baffling problems of Texas cattle fever, severe anemia, was Smith's crowning achievement. I am inclined, however, to give prominence to his work in tuberculosis, his progressive studies in diphtheria—especially the active immunization with toxin- antitoxin mixtures—the important investigations in "black-head" of turkeys, and his 75 or more papers establishing methods and modes of thought in general bacteriology. Also, many who have emphasized his tick fever work as the first proof of the biological spread of disease by an arthropod carrier have overlooked the observations of Patrick Manson, who some years earlier (1877-79) detailed the metamorphosis of Bancroft's filaria,[33] the causative agent in elephantiasis, with drawings of the different stages of the nematode in certain mosquitoes, especially *Culex fatigans*. Moreover, he showed that it is only in those mosquitoes that had fed on filariated blood that the metamorphosis occurred. Later he described the nocturnal swarming phenomenon in man.

Manson was aware that he had not carried out the important experimental transmission to man. He states: "I have not had the hardihood to attempt the *experimentum crucis* by filariating a man or lower animal by means of filaria metamorphosed in passing through the mosquito." In this respect, Smith and his associates had the advantage which always obtains in studying diseases of lower animals. They could and did carry out the crucial experiment of experimental transmission of the disease by infected ticks. In working with infectious diseases of man, we are always faced with the choice of a model, more or less successful, usually less. We may use small laboratory animals, dogs, monkeys, and even anthropoid apes to lay our foundations, but the final test must be in man, whether it is labelled an experiment or not.

Just as Jenner followed the folklore suggestions of the dairy maids in experiments which resulted in successful vaccination against smallpox, so Smith and associates followed the suggestions

of the cattle ranchers that ticks were in some obscure manner at the bottom of their troubles with Texas fever. Smith's first paper,[34] a brief preliminary one, appeared in 1889, then one of 191 pages[35] in 1891 and the complete report of 301 pages (with many details which we should now think unnecessary, such as method of making blood smears) in 1893 by Smith and Kilbourne.[36] This is a masterpiece of orderly reasoning, experiments to answer specific questions, and complete details of each animal used; it is a recognized classic in medical literature. I should like to report on this tick fever work in detail, the step-by-step progression is so beautiful.

Southern cattle bearing the latent infection were free from signs of the disease.

Infection was commonly transmitted only during warm months of the year; in depths of winter, the cattle were harmless.

The disease was not communicated directly from southern to northern cattle, but ground over which the former had passed was infected by them and thence in some unknown manner to susceptible cattle.

Southern cattle after remaining a short time on northern pastures lost the power to infect those pastures and remained harmless. Similarly, cattle that had been driven considerable distance lost the power to infect pastures.

When pastures and trails had been traversed by southern cattle, the disease did not appear at once when northern cattle were exposed to the land; a period of not less than 30 days elapsed before the cattle began to die.

The disease occurred either in an acutely fatal form during the hot months, appearing suddenly and as a rule in all the animals of a herd at the same time, or in the autumn as a mild, nonfatal, or chronic type. The usual signs and symptoms of the acute type were loss of appetite, constipation, staggering gait, delirium, very pale watery blood, slowed coagulation time, hematuria, rectal temperature up to 105-108° F., and death in 4 to 14 days. At autopsy the organs most involved were the spleen, which was much enlarged and engorged with blood, Malpighian bodies and trabeculae not visible, and the liver, also enlarged and congested with fatty degeneration and bile injection.

It is impossible even to suggest in one short paper the variety and detail of the experiments performed—"four years of slavery," as Smith called it. The manifest red blood cell destruction caused him to examine the cells from the blood and organs of sick animals and at autopsy. He was soon able to describe a pyriform parasite which he found in varying numbers in the red blood cells. He referred to early work of R. C. Stiles[37] who in 1867 had been the "first to lay stress on the changed condition of the blood corpuscles." He concluded from Stiles' description that he had actually seen the same organism which Smith now named *Piroplasma bigeminum*. He referred also to Babes' finding of "inclusions" in the red cells of

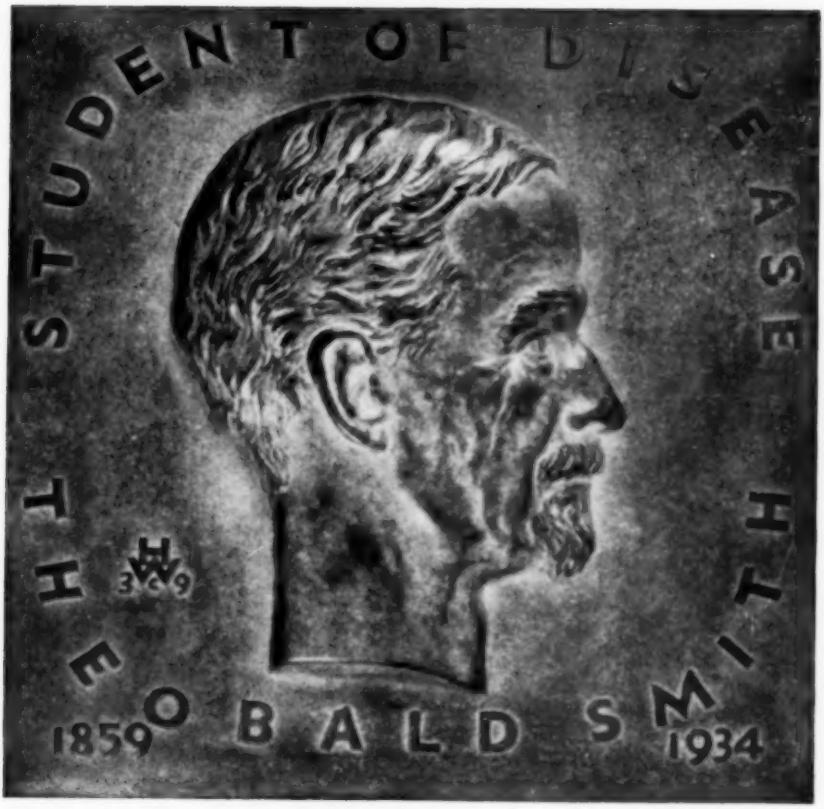


FIG. 1. This life-size low relief portrait was made by the sculptor Howard Weinman for the third International Congress of Microbiology held in New York in 1939 at the beginning of World War II. Small medallions were distributed to the members of the Congress.

Texas fever cattle (1888), but since the author succeeded in cultivating "these" as bacteria, Smith concluded that Babes was in error. The organism is now, however, commonly named *Babesia bigeminum*. In Smith's studies, it was found in fourteen outbreaks of the disease, two of them experimental, and not in normal northern cattle.

After a rather complete picture of the disease had been established, there came the tick experiments.

*Tick Experiments*

Smith and his associates showed laborious persistence hot summer after hot summer in field and in laboratory as they whittled away at the known facts and gradually dug out the answers from northern and southern cattle and from myriads of ticks. Each year, the farm land of the Bureau was divided into well-separated areas with "buffer states" between them. Here were separately enclosed (a) Texas cattle with ticks, (b) northern cattle without ticks, (c) sick native cattle, (d) northern cattle on which young ticks from southern cattle were placed; they became ill, (e) well cattle injected intravenously with blood from sick cattle; these became ill, (f) northern cattle kept in fields in which infected ticks had been scattered; these became ill, (g) sick native cattle from which ticks were laboriously hand picked each day for several days until one could be certain that no ticks remained; then well cattle were placed with these and remained well. *Sick cattle were harmless when the cattle tick was absent.*

Quoting from a summary (pp. 151-152) in the 1893 monograph:

> (1) Texas cattle fever is a disease of the blood, characterized by a destruction of red corpuscles. The symptoms are partly due to the anaemia produced; partly to the large amount of debris in the blood, which is excreted with difficulty, and which causes derangement of the organs occupied with its removal.
>
> (2) The destruction of the red corpuscles is due to a microorganism or micro-parasite which lives within them. It belongs to the protozoa and passes through several distinct phases in the blood.
>
> (3) Cattle from the permanently infected territory, though otherwise healthy, carry the micro-parasite of Texas fever in their blood.
>
> (4) Texas fever may be produced in susceptible cattle by the direct inoculation of blood containing the micro-parasite.
>
> (5) Texas fever in nature is transmitted from cattle which come from the permanently infected territory to cattle outside of this territory by the cattle tick *(Boöphilus bovis)*.

(6) The infection is carried by the progeny of the ticks which matured on infected cattle, and is inoculated by them directly into the blood of susceptible cattle.

(7) Sick natives may be a source of infection (when ticks are present).

(8) Texas fever is more fatal to adult than to young cattle.

(9) Two mild attacks or one severe attack will probably prevent a subsequent fatal attack in every case.

(10) Sheep, rabbits, guinea pigs, and pigeons are unsusceptible to direct inoculation. (Other animals have not been tested.)

(11) In the diagnosis of Texas fever in the living animal the blood should always be examined microscopically if possible.

## OTHER NOTEWORTHY CONTRIBUTIONS

Hardly had the major riddles of cattle fever been answered, when Smith's attention was drawn in 1893 to another economically important disease, infectious entero-hepatitis or "blackhead" of turkeys, which at that time was causing heavy losses especially in Massachusetts and Rhode Island. He spent August of 1894 at the Rhode Island Experiment Station at Kingston working on the disease; after a number of autopsies he concluded that he was probably dealing with an infectious process. In 1895 he published[38] a description of a new species of protozoan named *Amoeba meleagrida* (n. sp. 1895) that he found in the caeca and in the liver of the sick birds; it was later reclassified as *Histomonas meliagrides*.

Later, after his move to the Rockefeller Institute at Princeton, this was the first disease Smith again took up; I am impressed anew by his criticisms of the weak points of the evidence to date. He refers to the experiments of Moore who in 1895 transmitted the disease by feeding liver and caeca of diseased birds to healthy stock. Similar experiments of this general type in the hands of Smith and Graybill[39] gave inconsistent results. In four well-controlled experiments they showed that a small thread worm, *Heterakis gallinae*, commonly found in the caeca of turkeys and chickens, was "an accessory weakening agent, preparing the way for the specific agent of blackhead." "Eggs of *H. gallinae* were fed to turkeys and *then* the 'amoebae' produced the disease, but without the nematode only a few cases of blackhead occurred." These observations of the constant association of the nematode with this disease led to further studies by Tyzzer and Fabyan, two of Smith's early associates; they demonstrated a remarkable parasitic cycle, finding that the protozoan was actually carried along in the infected embryos of the nematode worm.[40] We are indeed "fearfully and wonderfully made."

The parasitologist, Maurice Hall, says that "this work alone would have insured Smith a permanent and high place 'as a student of disease'."

In 1895 Theobald Smith moved to Boston, where, as was mentioned earlier, he became Professor of Comparative Pathology in Harvard Medical School and also Director of the Massachusetts Antitoxin and Vaccine Laboratory. This latter position involved him in public health problems and the important tasks of preparation and standardization of smallpox vaccine and diphtheria and tetanus antitoxins. This more or less routine work, which many would have scorned, provides an example of the excellent use which Smith made of "material that came his way." Herbert A. Brown and E. L. Walker worked with Smith at this period.

They studied and emphasized the variation in capacity of different strains of diphtheria bacilli to produce toxin[41] and the variability of families of guinea pigs to react to diphtheria toxin and to produce antitoxin.

They improved methods for the production of diphtheria toxins.

They studied passive immunization of guinea pigs *in utero,* confirming the observations of Ehrlich and others, and determined the duration of this immunity.

They discovered that the young suckled by immune mothers acquired a passive immunity. Later, in the Princeton period, Smith returned to this study and with Ralph Little found that colostrum with its high antibody content against members of the *B. coli* group when fed early, would prevent "scours,"[42] the highly fatal diarrhea of newborn calves.

A more notable contribution arising from the Board of Health work was the finding (1907-1910)[43] that neutral mixtures of diphtheria toxin-antitoxin would incite antibody production in guinea pigs and protect them against fatal doses of toxin. Smith suggested that a similar procedure might be effective in man. In reviewing the literature he found that Dreyer and Madsen (1901) had reported somewhat similar studies, using mixtures of toxin-antitoxin with a toxon reaction, effective especially in rabbits, goats, and horses. Smith also reported that after completion of their researches, he found a preliminary paper by W. H. Park (1903) with similar results in horses. Behring's work along these lines came later, from 1913 and subsequently, but for all that he usually gets the credit rather than his predecessors.

Another contribution, probably the one with the widest ramifications in disease, was the so-called Theobald Smith phenomenon, the peculiar hypersensitivity of guinea pigs to a second injection of horse serum after an interval of some days, usually a week or more. While Smith was at Frankfurt Institute visiting Ehrlich, he told him about some of these "accidents" occurring during the titration of diphtheria antitoxin. Ehrlich gave the problem to his associate, Otto, who investigated the reaction extensively; they generously called it "Das Theobald Smith phaenomon" (1905). Apparently the only published statement that Smith made on the subject was given in an abstract of discussion following one of Rosenau and Anderson's anaphylaxis papers before the American Medical Association in 1906.[43] Smith stated that he had been interested in the phenomenon since 1902 but had made no special effort to analyze it. In his sample experiment presented in a table, he allowed an interval of only 2-3 minutes between the first and second injections of horse serum and used 3-5 cc. volumes in each injection. A small percentage of Smith's animals died (neither signs nor autopsy findings described); actually, a larger number of his controls, that had not received the primary injection, died than in the group that had received such injections. Possibly the horse serum was toxic in such doses. At any rate, informed persons would agree that in these experiments, Smith was not dealing with anaphylactic shock, making apparent the confusion existing at the time.

I cannot refrain from a few statements about Smith's investigations in contagious abortion of cattle which yielded some twelve papers including a critical monograph (124 pages) with R. B. Little[44] in 1923, especially the work on active immunization. Smith's first publication (with Marshal Fabyan) was in 1912 and he continued actively interested throughout the rest of his life with final publication[45] in 1933. Much of this work was along lines studied also by others in several countries. Smith, because of his experience with latent udder infections in tuberculosis, early (1912) expressed his fear of possible *Brucella* infections in man through the milk of infected cows. When Smith returned to his study of this disease in 1917 at the Rockefeller Institute at Princeton it was regarded as the most serious menace to the dairy industry. His efforts played a considerable part in the reduction of that hazard. One point which he noticed in the pathology of the disease merits attention, namely, the intracellular location of *Brucella abortus* in the epithelial cells of the chorion and his appreciation of

the importance of the multiplication of bacteria in cells lacking the enzyme systems of active phagocytes.

Smith and his associates also described with accuracy another organism, *Vibrio fetus*[46] (n. sp. 1918), which they found in some outbreaks of contagious abortion where the presence of *B. abortus* was carefully ruled out. Not as common a factor in the production of abortion in cattle as *B. abortus,* it must, however, be considered. It is more important in the production of abortion in sheep.

These glimpses of some phases of the productive career of Theobald Smith reveal why Professor Bulloch,[3] the British historian of bacteriology, felt that he "ranks alongside the greatest masters of bacteriology."

Smith was a shy man, an introvert who kept a personal diary in some detail during the formative years[8] from 15 to 24. After that period, the diary deals largely with the weather and obvious occasions. Philip Smith, his son, has said that the diary shows considerable indecision and doubt. But during this period Smith did well in all his studies, especially in mathematics and biology and later histology. In high school he belonged to a singing group and a debating society typical of the period. Music—the piano and pipe organ—was a great resource for this sensitive, self-contained man throughout his life; he earned some of his college expenses by "pedipulating" or by "blowing" the organ for others.

All agree that Smith was a perfectionist and impatient with less than the best, both in his family and among his laboratory associates. He felt that hard work and economy of time and money were necessary in life. He always maintained a well-ordered day with long hours, *"ohne Hast, ohne Rast,"* the planned year, the articulated work of several decades, and a mind ready to note the course of important bypaths. With Pasteur, Smith showed that "in the field of experimentation, chance favors only the mind prepared for discoveries by patient study and persevering effort."

Drawing from the remarks of one of his Harvard associates, Tyzzer,[47] who later succeeded Smith in the chair of comparative pathology, wrote: "Smith was modest, retiring, not especially robust, but showing a great amount of energy in his investigations and in attention to the business of his department. . . . It is well recognized that he was critical of evidence presented by other investigators, relying chiefly upon that of his own observation."

A few items learned from Philip Smith enrich the picture: "Father was extremely methodical. He routinized his life; he planned the use of his time far ahead; he was regular in his habits.

He greatly objected to hurrying; that betokened poor planning. He rarely suggested lack of time as a basis for refusal. He commonly arrived at the station 15-20 minutes before train time. But once he was late. He had been showered with many honors and had a trunk full of honorary degrees and their respective hoods, but was delighted when Yale informed him that they would be happy to honor him with an LL.D. degree. But, he missed the train by one week. He was terribly mortified and chagrined."

He drank coffee sparingly, his son reports, taking only that proportion of a cup after dinner that would aid in keeping him alert long enough to complete the planned reading or writing. He measured this amount quite exactly, a quarter, half cup or more as the case demanded. Once while walking in Switzerland together, they drank beer. The father became ill, attributed his illness to the beer, and thereafter abstained entirely from alcoholic beverages.

"In high school days, father wrote that Nature was his first love. He said, not too seriously, that his first choice of occupation would have been a tramp, second a musician or mathematician. The first was unthinkable; music impossible financially, but had opportunity presented he might have gone into mathematics."

In his well-regulated life, he worked late almost every evening, playing the piano until 8 o'clock when the young Philip went to bed. He especially enjoyed his summers in the family cottage on a point of land which they bought on Silver Lake near Chocorua, N. H. His days included botanizing, woodchopping, some rowing, no swimming, but reading and writing every morning. He always took a microscope and slides along for further study. The one man with whom Smith did unbend was his old professor and chief at Cornell, Simon Henry Gage. Great preparations were always made in the home when Gage was about to pay a visit. Much backslapping and free and easy conversation prevailed.

A few letters from some of those who worked directly with Smith will add details to our picture.

> Smith was meticulously careful and thorough. Details were much too important to be slighted or delegated to others. He kept careful notes on all he observed. A series of notes started, filed and added to as opportunity permitted, was never complete but always a growing piece of research. . . . With verbal criticism he was always moderate. He rarely offered praise. To be left alone by him was a compliment and made one feel that much was expected.[48]
>
> . . . The many stories about him center around his worst features. He was indeed pinchy; saved bits of string, worn out pencils, wrote little notes on the backs of slips of paper, etc. For years he collected the left over cigars at the annual board meeting in Princeton and handed them out often as

dry as dust, to his guests. I suppose much of this was really sort of a revolt against showmanship, which he detested. . . . He was always reserved; actually shy, but I never found him irritable. He did manage to irritate others and was rough on his technical help. There was much of the old German Herr Professor in his way of life. Withal he was kindly and thoughtful on occasion; an odd mixture, like most of us.[49,50]

In 1932, a few years after his official retirement, at a dinner given in his honor in Philadelphia, Smith was asked about certain attitudes which had guided his research. His replies were so illuminating that he was asked to put some of his remarks in writing; portions bring out the qualities of the man's mind so beautifully that they are here included.[51]

To those who have the urge to do research and who are prepared to give up most things in life eagerly pursued by the man in the street, discovery should come as an adventure rather than as the result of logical process of thought. Sharp, prolonged thinking is necessary that we may keep on the chosen road but it does not itself necessarily lead to discovery. The investigator must be ready and on the spot when the light comes and from whatever direction.

More and more our colleagues fail to understand our work because of the high specialization of research problems. We must not be discouraged if the products of our labor are not read or even known to exist. The joy of research must be found in doing, since every other harvest is uncertain and even the prizes do not always go to the discoveries to which we would assign them. Research has deserted the individual and entered the group. The individual worker finds the problem too large, not too difficult. He must learn to work with others. . . .

What is one man's meat is another's poison in research as in other vocations. Temperament goes far towards deciding our course. In the three different environments in which I have spent my active life I have always taken up the problems that lay spread out before me in the new environment, chiefly because of the easy accessibility of material without which research cannot go on; for in the early years material and resources were exceedingly scant and this meagerness determined the direction and scope of all research. My interest in a problem usually lagged when certain results could be clearly formulated or practically applied. To continue and analyze still further every link of the established chain either failed to hold my interest or was made difficult or impossible for causes lying outside the problem. As I look back it is precisely these links that have provided innumerable problems to others. Each link has grown into a chain and the end of successive chain making is not in sight.

May we now turn back to our first question; why no definitive biography* nor wide public recognition? Much of this lack of

* I have recently learned that a definitive biography of Theobald Smith is being written by Drs. Bang, Ferguson, and Stoll.

popular appreciation is typical of the public attitude towards all those who carry on fundamental studies in any science and shun publicity. Smith scorned showmanship and exploitation of science. Another factor, I believe, is that his fundamental studies related chiefly to diseases of lower animals. If Texas fever had been malaria, yellow fever, or poliomyelitis, just think of the commotion!

Acute powers of specific observation, quick correlations frequently with findings of his own or others long past, much time and effort in the formulation of the problem, his capacity to generalize and a capacity to write his findings in a simple logical style—these together with his power of long hours of continuous work were important bases of Smith's success. Like everyone else, he stood on the shoulders of those who preceded him and worked with colleagues and assistants of varying capacity. We grant his statement that "chance played an important part in his career." Anyone who has lived or read history knows that that is true for all of us. But "chance" did not produce the continuing stream of well-controlled experiments and outstanding achievements that came from Smith and his associates for half a century.

Philip Smith said that after his father had retired from the active directorship at Princeton, he asked him one day why he did not write his autobiography. His father's reply was characteristic; he pointed to about three feet of shelf space[52] on which was a row of heavy books. "There's my life. That's all anyone needs to know about it."

We need, however, a more complete picture. In order to emulate him, even afar off, we need to appreciate his love of nature, to see him chasing down in Gray's manual the unknown flower discovered in his rambles. We need to see him as a young man earning money at the organ and in his maturity relaxing at the piano. We need to observe his consistent, persistent efforts to follow a thread of hypothesis, frequently for years, to the gradual upbuilding of a well-grounded theory and demonstrated fact. We need to understand that his thrift, even in those examples that seem foolish and extreme, was based on a desire to conserve both time and money so that by careful planning there might be opportunity for the important experiment, the richer contact, or the more relaxing hobby. Foibles and failings of the truly great make them more approachable and permit us to emulate their strengths, with a kindly smile at their human weaknesses. All can rejoice that after Theobald Smith's retirement, time and energy remained so that he could give us his scientific credo, *Parasitism and Disease*.

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# Frans Jonckheere (1903-1956)

ROBERT O. STEUER*

DR. Frans Jonckheere, surgeon, Egyptologist, and a fervent student of the history of ancient Egyptian medicine, died prematurely on 10 March 1956. Born in Bruxelles on 30 June 1903, he studied medicine under brilliant auspices at the University there, acquired the medical degree in 1928, and later specialized in surgery. He gained considerable reputation as a surgeon and practised his medical profession until shortly before his death.

His close friend the Egyptologist Professor Baudoin van de Walle tells[1] in his obituary how Jonckheere became acquainted with Egyptology while traveling in Egypt in 1939 and was so impressed by this fascinating country and the overwhelming power of its monuments that he decided to study the language of the ancient Egyptians. This study was generously facilitated and encouraged by Professor Jean Capart who at that time taught Egyption archaeology at the University of Bruxelles.

Van de Walle tells us with what zeal and enthusiasm Frans Jonckheere tried to overcome and finally mastered the linguistic difficulties in this entirely new field of his scientific endeavours. Despite the fact that he was a practising surgeon, he became one of the most assiduous students of the Fondation Egyptologique Reine Elisabeth, the Belgian center of scientific activities in Egyptology. It is not surprising that so much diligence and perseverance attracted the particular interest of Professor Capart who in 1942 entrusted to Jonckheere a mummy[2] owned by the Musées Royaux d'Art d'Histoire in Bruxelles for experimental investigation. The result of this investigation was an extensive memoir with new observations concerning the technique of mummification and the conservation of flesh and bones.

There followed many other publications in Egyptian medicine and the history of science which cannot be analysed in this brief appreciation of the scientific personality of Frans Jonckheere, for his bibliography between the years 1942 and 1955 alone contains 33 articles connected with Egypt and nearly as many referring to various sections of the history of medicine and science.

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1 *Chronique d'Egypte*, July 1956, 303-308 (Contains the bibliography of F. J.).

2 Jonckheere, F. *Autour de l'autopsie d'une momie*. Bruxelles, 1942.

To two of the most important publications reference has already been made by Doctor J. B. de C. M. Saunders in his introduction to *Ancient Egyptian & Cnidian Medicine*[3] published in memory of Frans Jonckheere. In one of these publications[4] Jonckheere was able to prove that the Egyptians recognized the parasitical origin of Schistomiasis. In the other he gave a translation of the Chester Beatty Papyrus[5] from the hieroglyphic transcription of A. Gardiner. This papyrus has an intrinsic relationship to the whdw problem, discusses cases of ailments in which the anus and secondarily the heart are involved, together with specific therapeutic prescriptions.

A posthumous publication of Jonckheere has recently been brought out by the Fondation Egyptologique Reine Elisabeth,[6] saved from oblivion by van de Walle. In its general aspects it is a synthesis of what had thus far been discovered about names of Egyptian physicians and their functions. It enlarges considerably on what Jonckheere had already written in this respect[7] and contains a valuable complete list of the literature *(cf.* especially H. Junker's investigations).

Among the names of ancient Egyptian physicians whose genuineness Jonckheere considers proven are *eighty* with all their titles, from which one can deduce their specialties and rank within the medical organization of their time. Among the names mentioned are those of relatives (father, mother, sometimes brothers and wife, even the grandmother), and the monuments on which the names appear are accurately described.

If one follows Jonckheere's once accepted principle of considering as genuine only those whose complete names appear on dated monuments and whose relatives are mentioned, even Netherhetep, the only one mentioned by name within the medical papyri (Pap. Berlin 3038), must be considered a quasi-legendary figure, because he lacks the above precise characteristics.

Jonckheere's posthumous memoir is nevertheless outstanding with its beautiful illustrations of monuments on which appear names of ancient Egyptian physicians selected from different peri-

[3] Steuer, R. O. and Saunders, J. B. de C. M., *Ancient Egyptian and Cnidian medicine.* Berkeley, The University of California Press, 1959.

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[6] Jonckheere, F. *Les médecins de l'Égypte pharaonique: Essai de prosopographie.* Bruxelles 1959. (La Médecine égyptienne, No. 3.)

[7] *Chronique d'Égypte,* July 1951, 237-268; *ibid.,* January 1952, 129-143.

Frans Jonckheere 1903-1956

ods. It is unfortunate that Jonckheere could not have seen this most attractive volume in print and enjoy the results of his audacity in stirring up the Imhotep problem, one of the untouchables of traditional Egyptology.

What impresses one most while trying to scrutinize the personality of Frans Jonckheere and his burning, restless activity is the exceptionally wide range of his scientific interests, and this in the most diversified fields connected or not with Egyptology. He was greatly preoccupied with themes like circumcision of the ancient Egyptians, castration, and the problem of Eunuchs,[8] sexual mutilations ("phallatomie") such as the pictorial representations in Medinet Habu[9] which corresponds to the well-known biblical reports of David's exploits against the Philistines.

Jonckheere's affirmation of cauterization but strict denial of bloodletting as a therapeutic procedure in the Egyptian medical papyri should be mentioned. On a more didactic level the series of articles concerning the history of medicine which appeared between 1952 and 1955 in *La vie médicale internationale* in Bruxelles, deserve attention. They were destined for a wider public of practising physicians but their importance lies in their penetrating approach to particular periods and their manner of expressing clearly and efficiently what is important. The themes are most diversified indeed, reaching from Assyro-Babylonian and pre-Hippocratic medicine, the Corpus Hippocraticum, the Greek and Roman physicians (Galen, Celsus), those of Asia Minor, the Byzantines, Arabic medicine at its point of culmination (Rhazes, Avicenna) and its decline, up to the anatomy of Leonardo da Vinci and, last but not least, Paracelsus.

Having read a number of these articles one is impressed by their intense and interesting manner of presentation. They should be collected and translated into English as a work of art and a way of making the history of medicine attractive to students. The article about Paracelsus is a good example.

Of Jonckheere's genuine interest in everything which could throw new light upon ancient Egyptian medicine, especially its

[8] Jonckheere, F. L'Eunuque dans l'Égypte pharaonique. *Rev. Hist. Sci.*, 1954, 7, 139-155.

[9] Breasted, J. H. Medinet Habu. Earlier historical records of Ramses III. [The newest literature concerning Medinet Habu published by the Oriental Institute of the University of Chicago has not been available to the author.]

aetiology, I am a personal witness. The friends who knew him well had a great admiration for the purity of his altruistic personality—a fact proven by many sincere testimonials.[10] But what weighs most heavily from the spiritual angle is this—Frans Jonckheere was a genuine investigator, a fighter in the most idealistic sense for truth and scientific progress.

[10] *Cf.* also the elaborate necrology of F. J. by Paul Diepgen in *NachrBl. Gesch. Med.*, May 1956, No. 7.

# *Notes and Events*

*Edited by* Dorothy M. Schullian*

## *Jan Stephan van Calcar—Portraits of the Artist*†

With the publication of Vesalius' *De humani corporis fabrica* in 1543, medicine took its first long step from swaddling inunctions and Galenical recipes to stand firmly on the strong foundation of observed scientific data. Although Vesalius' position as a pioneering scientist has seldom been questioned seriously, considerable doubt has been raised over the artistic eye and hand which so painstakingly and precisely recorded his data. Jan Stephan van Calcar has definitely been associated with the anatomist in greater or lesser degree in the representation and publication of the *Tabulae sex*. However, skeptics over the past four centuries have made strenuous efforts to discredit Calcar's alleged contributions to the *Fabrica*.[1,4]

In recent years much doubt has been cast upon Jan Calcar's artistic talents.[7,10,11] Perhaps the most impressive evidence available to his detractors is his documented association with the *Tabulae sex*.‡ The contrast between its three clumsy skeletal figures and the graceful skeletons and musclemen of the *Fabrica* seems to be too great for a single talent to have bridged in a scant four years of practice and self-improvement. The fact that the figures in the *Tabulae sex* may be a faithful representation of clumsily posed and articulated skeletons has generally been ignored. Mr. W. M. Ivins, Jr. was perhaps the first to make this point in his brilliant, if vituperative, discussion of Vesalius.[3]

The doubts raised by the *Tabulae sex* have been further multiplied by a half-dozen obviously spurious "authentic" portraits of Vesalius that have been attributed to Calcar. These doubts have resulted in a questioning of the authenticity of an alleged portrait by Calcar of Cardinal Colonna in Rome. In addition, a rough drawing of the frontispiece for the *Fabrica* signed "Jean Calkar" bears the unfortunate date 1675. Calcar is believed to have died in Naples in 1546. The authenticity of a second drawing signed and dated "Joh. Stephanus, inv. 1540 Venetiis" has been similarly suspect.[9]

Further evidence against the thesis that Calcar was a leading artistic participant in the *Fabrica* also may be collected from the few art historians who have attributed the *Fabrica* to Titian. Annibale Caro (c. 1540) speaks of "the anatomy of Vecelli." Dominicus Bonavera (c. 1670) includes some

* Cleveland, Ohio.

† See also my note "Jan Stephan van Calcar: A little-known self portrait," *Bull. Hist. Med.*, 1959, *33*, in press.

‡ Table VI bears the following colophon: Printed at Venice by B. Vitalis of Venice at cost of Jan Stephan van Calcar. For sale in the shop of Signor Bernardo, 1538.[4,10]

of the figures in the *Fabrica* among the works of Titian, and this inscription is continued by Giuseppe Montani in his volume of anatomical drawings published in 1679.[6] There is no question that attributing to Titian, one of the great painters of all time, the graceful figures which mark the beginning of modern science is an intellectually delightful and subjectively heady pleasure. It is a "fact" which we all profoundly wish were true.

The cold, economic realities of the situation, however, are to be found in Vasari's chapter on Titian. At a time when Vesalius was an adolescent schoolboy at Louvain and Paris, Titian's portraits were already commanding a price of one to two thousand crowns.[13] This was in a booming artistic market where five hundred crowns was considered an exorbitant fee. It would be a rare vision which would cause so successful and busy an artist to apply himself to the yeoman task of making countless studies which resulted in four hundred precisely drawn anatomical displays scattered through some eighty-odd plates. All this "under supervision" and with the prospect of the doubtful remuneration to be expected from a textbook of anatomy. During this period Titian was busy painting portraits of the Hapsburg nobility and happily engaged in exposing a series of reclining Venuses to the gaze of assorted musicians, cupids, and interested passersby. It is doubtful that Vesalius' cool cadavers could meet this competition.

It is Vasari, again, who gives us our most substantial evidence in favor of Jan Calcar as the party responsible for the artistically pleasing plates of the *Fabrica*. The first edition of Vasari's *Lives of the Artists* was published in 1550, and restricted to the outstanding dead.* Calcar had been dead perhaps four years at that time, and is not mentioned. The second edition, published in 1568, was considerably enlarged, and contains three references to Calcar. Calcar is described as "he who designed his anatomy for Vessalio,"[10,14] and he is praised for his skill as a portraitist. Calcar had been dead some twenty years by this time, and Vasari's memory, while excellent, was not perfect. Whatever the details of the situation, and whether the reference is to the *Tabulae sex* or the *Fabrica*, it is highly improbable that Giorgio Vasari would have cast doubts upon his own artistic taste and ability by praising a second-rate, amateur talent.

By the same token, Vesalius himself, amateur artist, well traveled, and schooled to a high standard of artistic value, writes to the Renaissance humanist-philosopher, Marcantonio of Genoa, and speaks of Jan Calcar, "outstanding artist of our age."[5] Again, it is doubtful that Vesalius, ever conscious of moving in correct circles and being a man of taste, would have exposed himself to the humiliation of praising an incompetent.

Recently we have noted a little known self-portrait of Calcar painted in oil, and hanging in the Vasari Corridor of the Uffizi Gallery in Florence. This portrait is here reproduced (Fig. 1), together with the engraving from de Feyfer's definitive monograph on Calcar (Fig. 2).[2] Signor Ross, Super-

* Michelangelo (1475-1564) excepted.

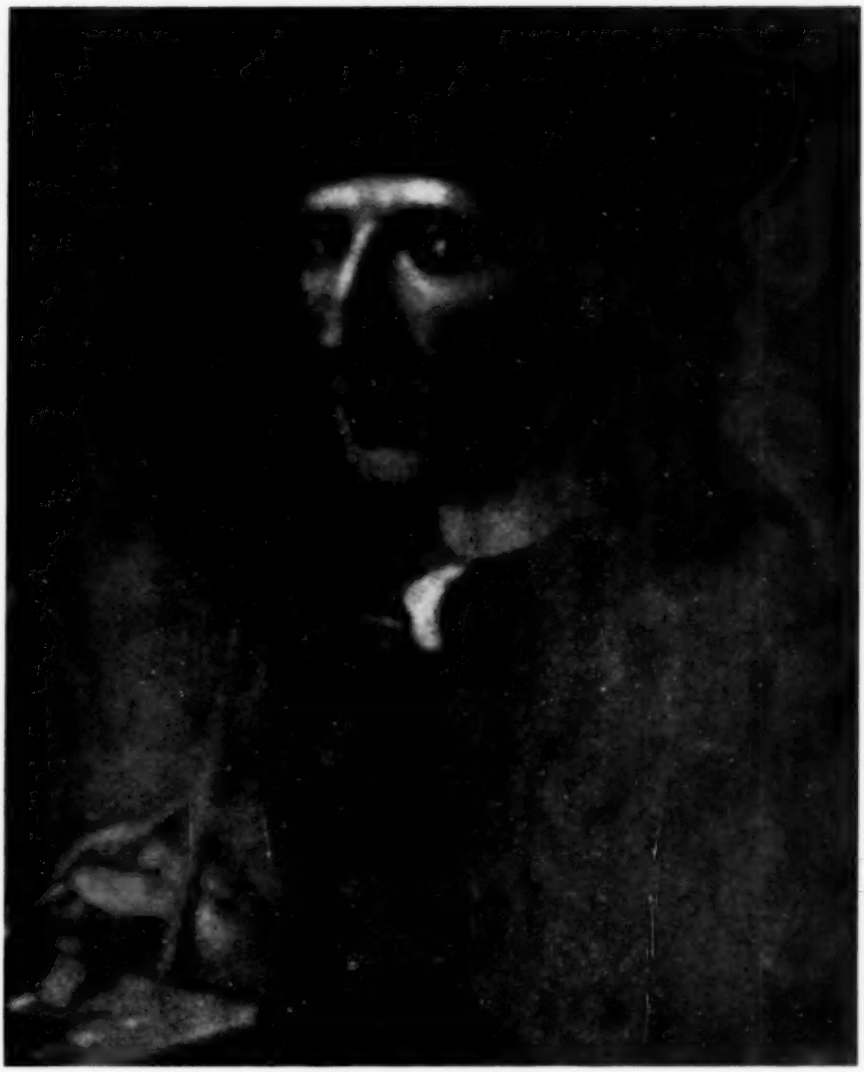

FIG. 1. Jan Stephan van Calcar. (Uffizi Gallery, Florence, Italy)

Fig. 2. Jan Stephan van Calcar, from de Feyfer.

FIG. 3. Vesalius, *Fabrica*, 1543.

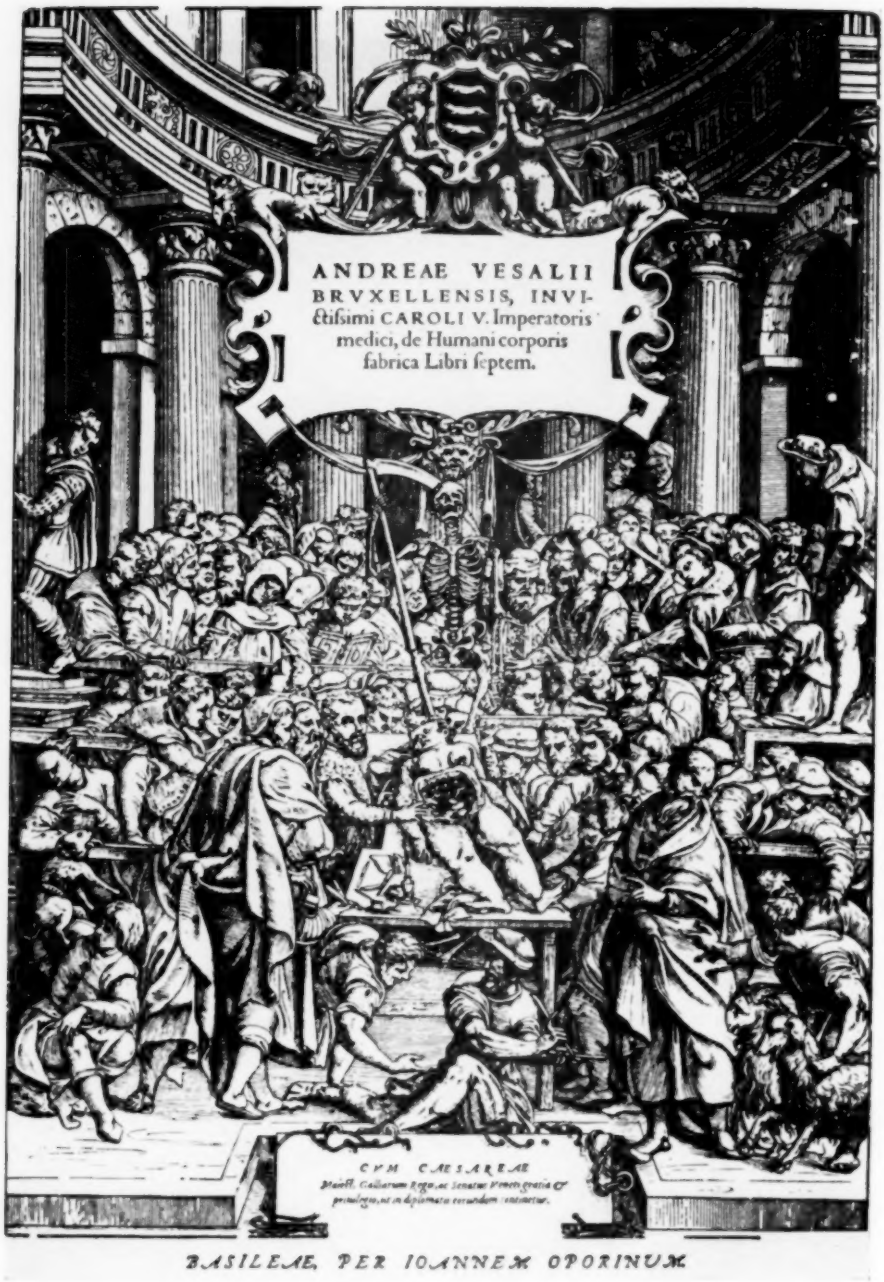


Fig. 4. Vesalius, *Fabrica*, 1555.

intendent of the Gallery, in a personal communication has attested to the authenticity of Calcar's self-portrait. The professional skill of the artist is obvious, and is certainly worthy of Vasari's citation.

The last part of our thesis is more tenuous. After presenting two extant portraits of Jan Stephan van Calcar, we attempt to answer the question: "Where in the frontispiece of the *Fabrica* lies the portrait of the artist?"

We are aware that over the past four hundred years many attempts have been made to identify the figures represented in the title page of the *Fabrica*. Vesalius' assistant, Realdus Columbus, is said to be the bearded figure in the foreground on the right. Vesalius' Swiss publisher, Johannes Oporinus, is believed to be the bearded man in the balcony on the right. Vesalius himself is easily identified in the center, unconventionally conducting the actual dissection. Two menials, who in more fastidious days had done the actual dissecting, have been relegated in the foreground to an appropriate position under the dissecting table (Fig. 3).[1,8,12]

Harvey Cushing was of the opinion that the figure in the first circle reading an open book to the left of the skeleton was Jan Stephan van Calcar. He read the initials on the cover of the book as "S. C.," and believed that the reader was thus identified as Stephan Calcar. Other observers have not seen these so clearly, and have identified these letters as standing for Claudius Galen ("C. G."), or merely as oval decorative motifs.[8] The figure standing before the open book certainly appears to be a young man, at most in his twenties, and not the forty-four-year old Calcar.

We believe that the portrait of the artist, Jan Stephan van Calcar, is represented by the beardless head, seen in profile, just to the left of Vesalius, and apparently looking over the dissector's left shoulder. It is interesting to note that this head is artistically suspended in space, since there does not appear to be room enough below to support a body. Rembrandt some ninety years later was to suspend a similar observer in his painting of "Dr. Tulp's Anatomy Lesson."

Our contention that Calcar has included a likeness of himself in the title page of the *Fabrica* rests on two observations. First, there is the more than coincidental resemblance between the profile suspended above Vesalius' left shoulder, de Feyfer's engraving, and the self-portrait of Jan Calcar reproduced from the Uffizi Gallery. The artist's cap, his prominent nose, and weak, beardless chin are all there, although the difference between the sketch and the finished portrait is obvious.

The second observation comes from study of the title page of the second edition of the *Fabrica* (Fig. 4). This was published in 1555, some eight years after Calcar's death, and the whole scene has obviously been redrawn. It is of interest that the artist who redrew this title page has left out the artistically inelegant head that floated so effortlessly above Vesalius' shoulder in 1543. It would seem that for the first time Jan Stephan van Calcar's presence was to be erased from the *Fabrica*.

In summary, then, we have attempted to present three portraits of the artist Jan Stephan van Calcar. The first, a self-portrait in oil, is authenticated and hangs in the Uffizi Gallery, Florence, Italy. The second is a copper engraving by an unknown hand. The third is a conjectured likeness in the frontispiece of Vesalius' 1543 *Fabrica.* We feel these figures lend credence to the thesis that Jan Calcar was, indeed, the precisely meticulous delineator of the "artistic production" *(fabrica)* of the human body.

ROBERT PROPER

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## *The American Harvey, Manuel Avalos y Porras**

Guatemala, a small country in Central America, which is a link between North and South America, has one of the most important figures in the annals of the history of medicine in the New World—the physician Manuel Avalos y Porras who performed the first vivisections recorded in the history of American medicine. From this fact Guatemala may be considered a cradle of scientific and experimental medicine. This physician was also the first to introduce various substances in the circulatory system in order to study their effects on the living organism and, most importantly, it was he who conducted the first practical demonstration in America of the circulation of the blood. Because of this we give him the honored

* Translated by Mary P. Wheeler.

title "The American Harvey," a name which has been recognized by many historians.

A document in the National Archives of Guatemala, catalogued as No. A 1, Exp. 1,149, File 45, year 1744, gives an account of the experiments performed by Dr. Avalos y Porras several years before this date, probably about 1740. Dr. J. M. D. Olmsted states that the first person in the United States to teach physiology with living animals, in the manner of Claude Bernard, was Dr. John Call Dalton (1825-1889). However, Dr. C. J. Reed in an article entitled "The history of the development of physiology in the United States" (*Illinois med. J.*, 1932, *61*, 220-226) says that it was Dr. Thomas Ewell who performed the first vivisection in America on a dog in 1805, about sixty years after the numerous vivisections performed by Dr. Avalos y Porras. In Mexico, which has one of the oldest universities on the continent and where the first American work on physiology was written, Dr. Manuel Carpio (1791-1860) is named as the first to perform experiments on living animals beginning in 1839, but this is disputed by the distinguished Mexican historian, Dr. J. J. Izquierdo; in Peru the Italian Dr. Federico Bottoni published a book on the circulation of the blood in 1723, in which he defended the theory of Harvey, basing his defense on experiments which he saw or personally conducted in Europe before he came to America.

One cannot help likening history to a rosary. The beads represent the great events, and the thread that holds them together the less important happenings; the thread is necessary for continuity. This is as true for the history of medicine in general as in any specific case or country. For Guatemala, the experiments performed by Dr. Avalos y Porras represent one of the greatest of accomplishments, particularly for the reason that they were the first on the American continent. After him medicine in Guatemala continued to develop at the University of San Carlos and also through the work of successive doctors who left the University to add other beads to the rosary, such as the invention by Dr. José Felipe Flores (1751-1824) of anatomical models of wax which could be taken apart in layers.

Dr. Manuel Avalos y Porras was born and died in the city of Antigua, which was formerly the capital of the Republic, and all his instruction was received in the University of San Carlos, founded in 1676. He was a very learned man. We have available the complete catalogue of the books in his library, and also we know that he had, according to the inventory which was made of his possessions when he died suddenly on 31 December 1775, "an instrument for measuring the grades of cold and heat," and two microscopes which unquestionably were the first on the American continent. Although his library included works by Hippocrates, Galen, Avicenna, Sydenham, Boyle, Malpighi, Boerhaave, Diemerbroeck, Verheyen, etc., and even the recently (for his time) published work on physiology by Marcos José Salgado (1727), which was considered to be the first work on physiology written and published on the American continent, we

do not find any indication that he had direct knowledge of the book of William Harvey. It is clear, however, that some of the experiments which he made to demonstrate the circulation of the blood were repetitions of the very ones which Harvey had performed.

In the document which has been mentioned earlier and which records part of a dispute with one of his fellow students for the chair of Prima de Medicina and for the Protomedicato, one of the witnesses called to testify as to who had first taught the students about the circulation of the blood states that Dr. Avalos y Porras taught "by means of ligatures on the veins and arteries how arteries are filled from the ligature back to the heart; while, on the contrary, the veins are emptied from the ligature to the heart and are filled from the ligature to the [outlying] parts."

Avalos y Porras made several more experiments to demonstrate the circulation of the blood which are recorded in the document mentioned above. We believe also that, when the history of experimental pharmacology on this continent is studied, it will be found that his pharmacological experiments, which consisted of injecting intravenously in dogs various substances in order to observe their effects on the organism, will prove to be the first performed in America.

Because of his unique experiments for the practical demonstration of the circulation of the blood, and because it was he who made this demonstration for the first time in the New World, we propose that Dr. Manuel Avalos y Porras be recognized by the title "The American Harvey."

HORACIO FIGUEROA M.

EDITOR'S NOTE: Readers wishing to investigate further the contributions of Manuel Avalos y Porras should consult Carlos Martínez Dúran, *Las ciencias médicas en Guatemala* (Guatemala, 1941), pp. 144-150 and John Tate Lanning, *The eighteenth-century enlightenment in the University of San Carlos de Guatemala* (Ithaca, 1956), pp. 209-303 of which contain four valuable chapters on Guatemalan medicine under the headings "The 'Latin' physician and the chair of medicine," "The *protomedicato:* the government, the university, and public health," "The progress of medical science," and "The teaching of surgery." Important also to an understanding of Harvey's influence in the New World is Francisco Guerra's article, "Harvey and the circulation of the blood in America during the Colonial period," *Bull. Hist. Med.*, 1959, *33*, 212-229. In addition, Dr. Horacio Figueroa has included a biography of Dr. Avalos y Porras in his book, *The history of physiology in Guatemala*, 1958.

## *The John Snow*

Readers will recall the note by the Editor of the Journal (1955, *10*, 428-429) which reported the celebration held in London for the centenary of the second edition of John Snow's *On the Mode of Communication of Cholera*. As one feature of the celebration a pub was dedicated at the site of the pump which in 1854 had spread an epidemic of cholera through water contaminated by sewage. To dedicate a pub in honor of teetotaler Snow is not altogether ironical, for brewery workers who did not drink the polluted water were his "controls." By vote of the Vestry of St. James's

THE PUB "JOHN SNOW", LONDON

**The pump was situated where the men stand and the well itself still exists below the pavement.**

Church, Westminster, his request to remove the handle of the pump was approved on 8 September, and the day is memorable to all sanitarians.

The Journal is pleased to publish now a photograph of the pub through the kindness of Dr. Fred B. Rogers, who sent it, and Dr. John J. Hanlon, who took it in 1956. Dr. Hanlon is Professor and Chairman, Department of Preventive Medicine and Public Health, Temple University School of Medicine, and the caption was added there when a lantern slide was made for teaching purposes. Dr. Hanlon's book *Principles of Public Health Administration* is now being published in its third edition by C. V. Mosby Company of St. Louis. His photograph will awaken pleasant memories for several medical historians of the United States who lunched at "The John Snow" in 1957.

### *Columbus Cemetery, Havana*

Historians of medicine are concerned with life and death. The Journal is honored to republish here the following lines on death which were written by Charles Upson Clark. Professor Clark's discovery of the Badianus Manuscript in the Vatican Library and his work on the history of yaws have been of conspicuous importance to the history of medicine. His note on the treatment of smallpox in Peru in 1589 was published in this journal, 1955, *10*, 327-331.

The lines, written more than forty years ago during a period of great personal grief, appeared in *The New York Times* of 3 July 1959 and are reproduced here by permission of their author and of that newspaper.

Tombs and crosses, crosses and tombs,
And the sigh of the wind in the mournful pines,
Waving pendants of moss, from the looms
Of the Funeral Fates, from their fell confines.

Altars and images, candle and wreath,
Gaudy trappings of sorrow and woe,
Marble inscriptions, buried beneath
Fragrant blossoms, with purple glow.

My dead lie where the oak leaves fall.
Over them maples and birches rise.
Bittersweet winds o'er the gray stone wall
By the cold clear brook, to wash our eyes.

That group by the soaring palm, on the sand
By pitiless spade upturned, near me,
Their careless tresses caressed and fanned
By the cooling breeze from the sinister sea.

I know them not, swarthy graceful forms;
Their soft sweet speech is of alien land;
But, brothers and sisters in grief's dread storms,
Our eyes meet——we understand!

### *Genetics in Sweden*

Special mention befits two recent studies in the genetic field which reach back into history for interesting data which in turn are discerningly and adroitly interpreted.

Carl Henry Alström provides in *Acta genetica et statistica medica* (1958, *8*, 295-369) a preliminary report entitled "First-cousin marriages in Sweden 1750-1844 and a study of the population movement in some Swedish subpopulations from the genetic-statistical viewpoint." The work, done from Laboratory No. 2 for Human Genetics, The Psychiatric Clinic of the Caroline Institute, Stockholm, examines the geographic and demographic relations of mating between first cousins in Sweden in 1839-1844 and the annual rate for the whole country since 1750; it propounds the hypothesis that in spite of an increase in intermigration, "subpopulations in different districts of Sweden in recent times have about the same first-cousin marriage rates as those found . . . to exist in the same regions more than 100 years ago." Four small rural subpopulations are examined with regard to isolation by distance, and the Swedish nobility is studied as a social isolate on the basis of its first-cousin marriages in 1750-1844 and its migration structure in 1680-1869. Figures for first-cousin marriages in the nobility are consistently higher than in the general population. The study is startling when it is recalled that at the beginning of the eighteenth century, when dispensations for such marriages were still required, the marriage rate between first cousins was approximately zero in both the nobility and society as a whole. It may be added that Sweden is particularly fortunate in possessing for such studies an unbroken series of official population statistics dating from the middle of the eighteenth century, and that valuable material even earlier in date is contained in its parish registers.

Dr. Alström, with B. Hallgren, L. B. Nilsson, and H. Åsander, calls the science of genetics to his service again to support clinical and endocrinological examinations in the description of a new syndrome, "Retinal degeneration combined with obesity, diabetes mellitus and neurogenous deafness," in *Acta psychiatrica et neurologica scandinavica*, 1959, Supplementum 129, Volumen 34, 35 pp. This is a specific syndrome distinct from the Laurence-Moon-Bardet-Biedl syndrome, the hereditary pattern in which appears to be recessive. For the new syndrome 413 ancestors were traced (for twelve generations back in certain lines); genetic analysis makes the separate symptoms manifestations of a recessive mutation in a single gene locus, and it is suggested that this hypothetical gene mutation occurred before the beginning of the nineteenth century and in the area, near Stockholm, where it has now manifested itself as a recessive autosomal condition.

### *Primus Conventus Europaeus Historiae Nosocomiorum*

Of more than European interest will be the First European Congress on the History of Hospitals, which will convene in the spring of 1960 in

Reggio Emilia and will then pursue its activities in various university towns of Emilia and Romagna.

The preliminary announcement has been issued in the Italian, French, German, English, Spanish, and, as evidenced by the title of this note, Latin languages; the first five will be the official languages of the Congress. The three main themes will be the historical aspects of hospital technique (sanitary organization, hospital architecture, pharmacy in hospitals, relations with the medical faculties of universities); the evolution of the hospital from the legal and economic point of view (statutes, relations with religious authorities, relations with state and local authorities); the ethical, cultural, artistic, scientific, social, pedagogic, and religious functions of the hospital through the ages. Papers are to stress European interests and where possible the relations between nations.

Further details may be obtained from the Organizing Committee at the Centro Italiano di Storia Ospedaliera, Arcispedale S. Maria Nuova, Reggio Emilia, Italy. The President of the Centro is Prof. Dott. Corrado Corghi, the General Organizer Conte Dott. Walter Soliani Raschini, the Secretary of the Committee Dott. Maria Bertolani Del Rio. Among the members of the Committee from nations other than Italy are Dr. Ernest Wickersheimer, Sir Geoffrey Keynes, Prof. Johannes Steudel, and Prof. Pedro Laín Entralgo.

*Further Notes on the Library of José Joaquin Izquierdo in Mexico*

The *Gaceta médica de México* for October 1958 (*88*, 749-766) contains an article by Dr. Izquierdo, "La hemerobiblioteca del Departamento de Fisiología de la Facultad de Medicina." The author, who has written a fascinating book about the four centuries of Mexican physiology, describes the origin, development, and present library of the Department of Physiology in the School of Medicine of the University of Mexico. The Laboratory of Physiology, organized in 1900, inherited an old building once used by the Inquisition, and in 1919 had, as the core of its library, 117 books and 30 volumes of journals, including the *Journal de physiologie expérimentale et pathologique* for the years 1821-1831, purchased by don Manuel Carpio (1791-1860), who was a prominent personality, a great admirer of Magendie, and a promoter of experimental investigation in Mexico.

From 1934, when the library of the Department of Physiology was opened, Dr. Izquierdo has been most active in its development; the catalogue published in 1950 included 150 periodicals (about 2,000 volumes). The beautiful buildings of the new "Ciudad Universitaria" now provide suitable space, and the departmental library has a fine large reading room. Bronze busts of Harvey, von Helmholtz, Claude Bernard, and Pavlov are reminders of inspiring research of the past. On the walls can be seen the first page of the first pamphlet in physiology written and printed on the American Continent (in 1727, by Marcos José Salgado) and the first page

of the *Praelectiones* by Luis José Montaña (1775–1820), one of the most distinguished medical figures of Mexico and the subject of another of Professor Izquierdo's books. The library specializes in physiology, biochemistry, and pharmacology, and lately has expanded to include sections in philosophy and the history of science.

Mexican students and scientists are indeed indebted to Professor Izquierdo for his enthusiastic and intelligent efforts in behalf of this library, whose organization is explained in detail in the paper.*

JOSÉ M. R. DELGADO

* See also the note by the Editor of the Journal (1958, *13*, 549-550) and *Catálogo de la Hemerobiblioteca del Departamento de Fisiología, Facultad de Medicina de la Universidad Nacional Autónoma de México* (México, 1958), 206 pp.

### *American Institute of the History of Pharmacy*

The American Institute of the History of Pharmacy, from headquarters at the University of Wisconsin School of Pharmacy, Madison 6, Wisconsin, continues to promote the history of pharmacy nationally and internationally.

The fifth Urdang Medal, an award given "for original and scholarly publications or series of publications pertaining primarily to historical or historico-social aspects of pharmacy, appearing anywhere in the world," has recently been conferred upon Maurice Bouvet of Paris. Dr. Bouvet was cited particularly for his *Histoire de la pharmacie en France des origines à nos jours* (Paris, 1936) and for his monographs on the French health service during the American Revolution and the history of hospital pharmacy. The medal was presented by Professor Alex Berman before a meeting of the French Society for the History of Pharmacy.

For workers in the field the Institute prepared "Some pharmaco-historical guidelines to the literature," which appeared in the *American Journal of Pharmaceutical Education* (1959, *23*, 143-172); separates may be obtained from the Director of the Institute, Glenn Sonnedecker, at fifty cents each. The three bibliographical essays included are Dr. Sonnedecker's on pharmacy, J. Hampton Hoch's on pharmacognosy, with emphasis on materials in English, and Wolfgang Schneider's on pharmaceutical chemistry, with particular reference to German literature.

With the design of preserving current data for the future the Institute is sending everywhere to licensed pharmacists whose work seems to hold promise of being historically memorable a four-page biographical questionnaire. Queries appear in both French and English, and it is hoped that by this means personal records, photographs, and publications will be funneled into the Institute's collection. Copies of the questionnaire are available on request. Somewhat more comprehensive records are being attempted for American contributions.

## *The Death of Charles Darwin*

The *Journal* bids farewell to the centenary year of Charles Darwin's work *On the Origin of Species* by publishing two letters, written by two of his children, which provide details concerning the death of the great naturalist. The paragraphs covering the first letter and the collection to which it belongs have been prepared, at the Editor's request and with Dr. Robert M. Stecher's consent, by Dr. Genevieve Miller of the Cleveland Medical Library, Assistant Professor of the History of Medicine, Western Reserve University, Cleveland, Ohio.

### I. FRANCIS DARWIN'S LETTER DESCRIBING HIS FATHER'S DEATH

The following letter, from the Darwin collection of Dr. Robert M. Stecher of Cleveland, was written by his son, Francis Darwin, to the Rev. J. Brodie Innes, the former Vicar of Down who was a lifelong friend of Charles Darwin. The details amplify somewhat the brief account of his father's death which Francis Darwin published in his *Life and Letters of Charles Darwin* (New York, 1959, Vol. II, p. 529). Undated, the letter was written some time after Wednesday, 19 April 1882 when Darwin died and before Tuesday, 25 April, the day proposed for the funeral. However, instead of being buried at Down as this letter suggests, upon the petition of twenty members of Parliament Darwin was interred at Westminster Abbey near Sir Isaac Newton on Wednesday, 26 April 1882.

Down,
Beckenham, Kent.

———

Railway Station
Orpington,S.E.R.

Dear M^r^ Innes

You will have heard before this of my dear father's death. We all know the strong & affectionate regard you had for him & we feel that you should be written to among the first of those beyond our relatives.

We have been uneasy about his heart for some time past but we did not think there was immediate danger. On Tuesday night at 12 o'clock he was attacked with pain in the chest and fainted away. He soon recovered from this faint & the pain left him after some time but he remained terribly weak & faint and suffered from terribly distressing nausea & occasional exhausting retching. He became gradually very cold & pulseless but remained conscious up to within a quarter of an hour of his death which took place at 4 in the afternoon of 19^th^ He seemed to know he was dying from the first and was not afraid to die, & indeed in his suffering he wished to die. My mother bears it bravely & is very calm, I think the feeling that he does not survive her is a comfort, for she feels that he could not have born the loss as she can.

I think he will be buried here, probably on Tuesday—I know it is not for me to speak of the friendship that existed so long between my father & you,

but I may at least say how often I have heard him speak of you in warm-hearted & kindly words

Yours dear Mr Innes
Sincerely
FRANCIS DARWIN

I have only just seen your kind letter to my mother

Dr. Stecher's collection includes the first editions of all of Darwin's books and 94 autograph letters written between 1846 and 1882, of which only a few excerpts have been published. There are 34 letters to H. W. Bates, author of *Naturalist on the River Amazons* (1863), 25 to the Rev. J. Brodie Innes, 6 to Lady Dorothy Nevill, 2 to his cousin Francis Galton, and one each to Alfred R. Wallace, Sir Joseph D. Hooker, Charles Kingsley, and Sir Roderick Murchison. In addition, there are letters by Francis Darwin, Emma Darwin, G. H. Darwin, Alfred R. Wallace, and miscellaneous items such as the invitation to Darwin's funeral in Westminster Abbey, the funeral program, photographs, and a sketch of the study at Down by his cousin Julia Wedgwood.

### II. LETTER OF HENRIETTA E. (DARWIN) LITCHFIELD

The second letter was written on the day after the death of Darwin by his daughter Henrietta E. (Darwin) Litchfield. The Camilla to whom it is addressed has not as yet been identified. The letter was presented to the Yale Medical Library on 7 August 1959 by John S. Kebabian of Scarsdale, New York.

Down—Thursday 20. 82

My dear Camilla,

You will have heard how unwell my Father has been for 5 or 6 weeks but I am sure it will be a great shock to you to hear that he died yesterday afternoon. He was taken ill the night before & had severe pain for a little & great exhaustion. The pain left him some hours before he died but he was very miserable up till the last sleep from wh. he never woke. Mother bore it wonderfully & is beautifully calm & patient now. I do not think it will do her harm.

He told her he was not the least afraid of dying—& sent us all a loving message. We do not know what it is yet & I can only write a catalogue of facts. But I know you will deeply sympathise with Mother—& us all

Yours affecly.
H. E. LITCHFIELD

Readers who wish to learn something of Down House, where "Darwin thought and worked for forty years, and died 1882," should turn to Benjamin Spector's moving article in the *New England Journal of Medicine,* 1959 (28 May), *260,* 1119-1124.

### *The Beaumont Memorial Foundation*

Some years ago physicians of the State of Michigan laid plans for the formation on Mackinac Island of a suitable memorial to William Beaumont (*Journal*, 1953, *8*, 333). The abandoned retail store formerly belonging to the American Fur Company was acquired, the building was restored, and the Beaumont Memorial was dedicated on 17 July 1954 with appropriate ceremonies. Three years later, at the annual meeting of the Michigan State Medical Society in 1957, the House of Delegates of the Society formally authorized establishment of an incorporated body to be known as the William Beaumont Memorial Foundation. During the first year following its incorporation, 364 doctors became members, 14 of whom were Life members. The Foundation was brought into being by 10 incorporators, all physicians within the state; it is directed by a Board of Trustees of nine members and by four Officers as follows: President, Otto O. Beck, Birmingham; Vice-President, William LeFevre, Muskegon; Secretary-Treasurer, Mr. William J. Burns, Lansing; Consultant, Eugene T. Petersen.

Attention is directed to the Beaumont Memorial Foundation number of *The Journal of the Michigan State Medical Society* (May 1959, *59*, 735) which contains a symposium of nine historically orientated papers devoted to Beaumont, four of them by the indefatigable Beaumontian Alfred H. Whittaker, one of which is devoted to the "Army Uniform of 1822." This, incidentally, is well illustrated by a beautiful colored reproduction of the Deane Keller portrait which hangs in the Beaumont room of the Wayne County Medical Society of Detroit (a copy of the original Yale portrait). Dr. Whittaker's geographical discourse "Centers of Beaumont Interest" is valuable as indicating 11 separate centers in the United States and Canada having Beaumont Clubs or special collections of his books and memorabilia. Following the Beaumont symposium there is a general symposium on syndromes of malabsorption and diarrhea as illustrating some of the current work in clinical gastric physiology. Dr. Whittaker and the Editors of the *Journal* are indeed to be congratulated on this fine tribute to the memory of a great physiologist.

J.F.F.

### *George Dock Lecture, Barlow Society of the History of Medicine*

The annual George Dock Lecture was held in the Library of the Los Angeles County Medical Association on the evening of 15 May 1959, under the auspices of the Barlow Society of the History of Medicine. Professor Charles D. O'Malley of the Department of History of Stanford University spoke on Dr. John Caius of Norwich. He traced delightfully the many associates of this sixteenth-century English scholar, including Vesalius, Gesner, Colombo, Münster, and Drivère, and discussed the medical tradition that has

accrued to Caius at the University of Cambridge. The text of the lecture has been published in the *Bulletin of the Los Angeles County Medical Association* for 20 August 1959.

### *William Osler Memorial*

The Medical Historical Club of Toronto plans to erect a memorial to Sir William Osler on the site where this great physician was born, at Bond Head, on July 12, 1849. This memorial is to be a cairn, erected on a plot of ground purchased by the Club, marking the site of the church in which Osler's father was Rector at the time of his son's birth. The Club will be pleased to receive contributions from anyone who wishes to assist in the completion of this memorial. Checks should be made payable to the Medical Historical Club and sent to the Secretary, Dr. Eric A. Linell, 253 Blythwood Road, Toronto 12, Ontario, Canada.

### *Staff Changes at the Smithsonian Institution*

Sami K. Hamarneh, Ph.D., has been appointed Associate Curator of the Division of Medical Sciences in the Smithsonian Institution. He will be in charge of the pharmaceutical collections and the Hall of Health in place of Mr. George Griffenhagen who has recently resigned to take a post with the American Pharmaceutical Association. Dr. John B. Blake has assumed Mr. Griffenhagen's administrative duties and is now Curator of the Division of Medical Sciences.

Dr. Hamarneh, a native of Jordan, came to the United States in 1952 and is now a citizen. He was trained as a pharmacist in The Syrian University at Damascus and also received an M.S. in pharmaceutical chemistry at North Dakota State College. He completed his doctorate in the history of pharmacy and the history of science in June 1959 at the University of Wisconsin, where he presented a thesis on "Some Pharmaceutical Aspects of Al-Zahrawi's *Al-Tasrif*."

### *Frederick Simon Bodenheimer 1897-1959*

The Journal regrets to record the unexpected death in London on 4 October 1959 of Frederick Simon Bodenheimer, the distinguished Emeritus Professor of Zoology of the Hebrew University of Jerusalem. Dr. Bodenheimer had taken an active part in the IXth International Congress of the History of Science at Barcelona and Madrid in September of this year; and he had served as President of the VIIth International Congress when it met in Jerusalem in August 1953. He was also President of the Israeli Society of the History of Medicine and Science. A full appreciation by Walter Pagel of London will follow in the next number of the Journal.

### *Thirty-third Annual Meeting of the American Association for the History of Medicine*
### *Charleston, S. C., 24-26 March 1960*

The Thirty-third Annual Meeting of the American Association for the History of Medicine will be held in Charleston, South Carolina, 24-26 March 1960. The Association's host will be the Robert Wilson Medical History Club. Dr. J. I. Waring is the chairman of the Committee for Local Arrangements.

Members who wish to present papers are asked to send an abstract of not less than 500 words to the chairman of the Program Committee, Dr. Paul F. Cranefield (State University of New York, Downstate Medical College, 450 Clarkson Avenue, Brooklyn 3, New York) not later than 1 January 1960.

# *Book Reviews*

MARTIN LEVEY. *Chemistry and Chemical Technology in Ancient Mesopotamia.* Amsterdam, Elsevier Publishing Company, 1959. xii, 242 pp.

*Reviewed by* HENRY M. LEICESTER, *Professor of Biochemistry, College of Physicians and Surgeons, San Francisco, California.*

IT is an obvious fact that in any historical study, in medicine or science as in any other field, the consultation of original sources is the first essential. From such materials interpretive syntheses can be built up which can then be used as secondary sources by those who lack the time or the ability to turn to the originals. In this way the various types of historical writing, from specialized monographs to serious studies and popularizations of all degrees of authenticity, come into being. Without the sources nothing can be accomplished.

There is no lack of source material in the history of science from the period of the Greeks until the present, and no lack of competent scholars to interpret it. However, anyone who consults a general history of science or medicine today finds an almost complete lack of information on the pre-Greek period. Most scholars now recognize that Greek science did not arise as the sole creation of the Greek philosophers and physicians but was founded on the discoveries and techniques of the Egyptian and Mesopotamian civilizations which had preceded them. The general histories seldom go beyond a statement of this fact.

The explanation is not difficult to find. The only scholars in the past who were capable of reading the source materials were the specialists in philology who lacked any interest in science or technology. However competent these men were in reading the languages of Mesopotamia or Egypt, their primary interest lay in the mythological and religious texts. As R. J. Forbes mentions in the introduction to the present work, a vast number of texts vaguely classified as "economic" have been neglected by scholars who had no interest in science. As a result, our picture of the ancient Mesopotamian civilization tends to emphasize the superstitious aspects, the emphasis on omens and astrology, and the strong belief in demons.

Now we have a corrective for this viewpoint. A scholar who is thoroughly acquainted with the languages of the Near East, not only Sumerian and Akkadian, but Egyptian, Hittite, and the more modern tongues such as Hebrew, Syriac, and Arabic, has given us a synthesis based on actual translations of the original tablet literature. This includes the earliest known medical work, in Sumerian, dating from about 2100 B. C.

There is more than this, however. Levey is also a trained chemist who understands the significance of the material which he reads, and so is not lured into ascribing to the ancients knowledge which they did not possess.

The only other extensive writer on Babylonian chemistry, R. C. Thompson, who was not a chemist, sometimes made this mistake. In the present work Levey has presented the text themselves, mostly in the original translation, and has cleared up many of the difficulties of interpretation by the use of a variety of resources. He has used comparative linguistics to show the meaning of an unclear text by showing the similar wording in Hebrew or Arabic; he has recognized the chemical reaction involved in the processes which he is describing and so has been able to identify the probable nature of the materials used when the terminology is unknown, and he has showed how the technology of the ancients can be understood by referring to the processes as used by the medieval Arabs, or even by the modern inhabitants of the same region.

The clearest example of the latter method is to be found in the chapter on perfumes in which he compares the perfumery texts of the later centuries of the second millenium B.C. with the treatise on perfumes of al-Kindi in the ninth century A.D. The methods of the Arab were basically the same; only minor improvements in apparatus had been made. The technology of the Mesopotamians was obviously handed down directly, probably by oral transmission, to the Arabian workers millenia later.

With this in mind it becomes possible to explain or understand some of the puzzling features of later Greek or Arabian alchemy. For example, there has been much debate as to whether women among the Greek alchemists occupied as important a position as the frequent mention of such names as Maria or Cleopatra would imply. Also, why did the Arabian alchemists such as Jabir require that certain laboratory operations like distillation be repeated hundreds of times, even though no apparent advantage could be obtained from this?

It now appears that perfume-making in Mesopotamia was largely in the hands of women, and the apparatus with which they worked was derived directly from that of the kitchen. Probably the tradition of women as workers in the alchemical laboratory was well established among the technicians of Alexandria, where alchemy originated.

Again, with the relatively crude distillation apparatus of the Akkadians, it was essential to repeat a given operation many times to obtain a useful yield of product. Even though the Arabs improved the design of their stills, they were sufficiently under the spell of the ancient craftsmen to continue the innumerable repetitions of their processes.

This aspect of Mesopotamian thinking will also be of the greatest significance to the historian of science in general, that is, to the historian of human thought. We must re-evaluate our ideas on Mesopotamian science, and the basis for such re-evaluation is to be found in books of this sort. Unfortunately, it is very rarely that such books appear.

While the author has given us a wealth of new and fundamental material, his book is a vivid illustration of how much more remains to be done in this field. The texts which he has quoted were selected from the widest

types of material: letters, lexical lists, temple inscriptions, royal reports. They range over a period of more than three thousand years. Yet they leave tantalizing gaps. The essential details of many processes are not given, the nature of many of the materials used can only be guessed at, since the specific names cannot be translated today. It will require the work of many scholars with the special abilities of the author to unravel these difficulties. Such scholars are not often to be found.

Some of the material in this book has been published elsewhere, in a number of individual brief articles and in a variety of journals. The value of these works is now increased by bringing them together, along with much new matter, with interesting illustrations and with adequate name, subject, and foreign word indexes. The whole makes up a sourcebook for future studies which is unique. All historians of chemistry, medicine, and science owe a debt to Levey which cannot soon be repaid.

G. GUILLAIN. *J.-M. Charcot (1825-1893): his Life—his Work.* Edited and translated by Pearce Bailey. New York, Hoeber, 1959, xvi, 202 pp. $7.00.

*Reviewed by* PERCIVAL BAILEY, *Professor of Neurology and Neurosurgery, University of Illinois, Chicago; Director, Illinois State Psychopathic Institute.*

THIS book gave me an acute attack of nostalgia. Oh, the glorious days of my youth! When I was a foreign assistant at the Salpêtrière in 1921-1922, the old hospice was still dominated by the spirit of the great physician. I have been in his office, his library, his clinic, even lectured in his amphitheatre. I was assistant in the service of his assistant, Pierre Marie, and visited often the service of the successor of his friend Vulpian, A. Souques, whose intern was Th. Alajouanine, now professor in his turn. All of the scenes of the book are familiar to me. Babinski was still active at the Pitié, the pupil whose academic career was blocked by another pupil, Bouchard. Yet Bouchard was only acting like his master, using all the weight of his influence to advance one of his own pupils; Charcot did not believe in examinations for the higher positions in the academic hierarchy.

The first half of the book is devoted to a brief account of Charcot's life, his character, his habits of work, his routine of daily living. In my time the service was conducted much as he had established it—the informal Tuesday external consultation, the Friday lecture, and the daily visit at the hospital where all gathered around the professor to whom the patients were carried; only then the patients were brought to the Pavillon de la Grille instead of the clinic so familiar to everyone from the classical painting by Brouillet. Marie's successor, Guillain, moved the visit back to Charcot's clinic, practically unchanged to this day.

Many were the stories I was told of the founder of modern clinical neurology, all of which are reflected in this book which paints a picture much as it was told to me, except it seems to me that not enough is made

of Richet, and there is one error: it is stated on page 60 that "Through Charcot he [Sigmund Freud] met the medical psychologist, Pierre Janet, with whom he discussed the problems of hypnosis and the unconscious." Freud was at the Salpêtrière in 1885-1886, at which time Janet was teaching philosophy at Le Havre. Janet did not come to Paris until 1889. Years later he tried to visit Freud in Vienna, but Freud refused to see him.

The second half of the book contains a succinct account of Charcot's scientific work. There is no question that he founded the anatomico-clinical method on which clinical neurology rests. Before he was appointed to the Salpêtrière in 1862 he had already shown his ability by distinguishing chronic articular rheumatism from gout and later, during his tenure of the chair of pathological anatomy (1872-1881), he established the notions of the pulmonary lobule, the hepatic lobule and the renal lobule which oriented pathological investigation toward the study of nephritis, hepatic cirrhosis, and pulmonary disease. But his notable contributions, which established him as one of the greatest medical scientists of all time, were concerned with the nervous system. In his own country they resulted in the creation of the first chair to be devoted to nervous disease (1882); abroad they brought him many honors and an extensive consulting practice which he carried on, as is the custom in France, in his home with his personal assistant, Pierre Marie.

What a list of creations! Amyotrophic lateral sclerosis (Charcot's disease), amotrophy of Charcot-Marie, multiple sclerosis, tabetic arthropathy (Charcot's joint), spastic spinal paralysis, etc., etc. During these years (1882-1893), he was not only investigating but passionately teaching. His lectures, gathered into volumes by his pupils, were translated into many languages. They dealt extensively with the problems of localisation of function in the cerebrum and spinal cord. Only the problem of aphasia he shied away from, leaving it to his assistant, Pierre Marie.

All of the foregoing is well known and generally accepted. However, on pages 133-179, there is an account of a phase of Charcot's work which has aroused much controversy. This study is very welcome. Guillain relates how, because of the closure of the psychiatric service of Dr. Delasiauve, a large number of epileptic and hysteric patients were crowded into the service of Charcot. They were cared for by him in a manner much shrewder and less gullible than he is usually given credit for. The author corrects many of the false notions which have gained credence concerning this period of Charcot's life. He tackled their problems, as he did all others, tenaciously, courageously, and honestly. Some of his errors were the result of not making visits into the wards; he was led into them by his assistants and pupils. "Charcot himself finally understood, even though a little late, that he was being beguiled into an uncertain terrain. Unquestionably in this respect he was influenced by his old chief of clinic and private secretary, Pierre Marie, who always refused to become identified with the experiments of hypnotism." Which did not prevent Pierre Marie later

from falling into the same trap and for the same reason, as I was able to witness, that he never went into the wards. "Shortly before his death Charcot decided to revise his entire work on hysteria and hypnotism. But by this time he had frequent attacks of angina pectoris, and knew that he was very ill." He managed only to write a little known but interesting article entitled "La foi qui guérit."

It was during this period, when Charcot was trying to differentiate between what are now called "organic" and "functional" disorders of the nervous system, that he had the dubious honor of introducing both Janet and Freud to these problems. Also a witness of all this was J. Babinski. Janet the philosopher; Freud the visionary; Babinski the searcher—an interesting trio. It is illuminating to compare their methods of attacking these problems. We may take as an example one of the many facets which Charcot called to their attention, the diagnosis of paralysis. Janet's philosophising *(Archives de Neurologie,* 1893, *25,* 417-438) resulted in the idea that the hysterical patient realizes in his paralyses the popular conception of the limits of the limbs. The results of Freud's padded futile ruminations *(Archives de Neurologie,* 1893, *26,* 29-43) are presented in four parts: in the first part he reviews what he admits are the generally accepted views about organic paralyses and coins a couple of new terms (which this time did not catch on); in the second part he talks more about aphasia, sensation, and other symptoms (which he admits are outside his subject) than he does about paralysis; in the third part he agrees with Janet's ideas; in the fourth part he speculates on which should be the nature of the lesion causing the paralysis. Meanwhile the patient observations of Babinski—methodical, obstinately repetitive; a method with which neither Janet nor Freud (as Jones notes) had any patience—established *(C. R. Soc. Biol.,* 22 fév. 1896) the *Sign,* one of the rocks of the foundation on which clinical neurology rests.

This book is of especial interest to me for sentimental reasons, yet it should be interesting to any physician since it deals with a dominate figure who played a leading role in the establishment of an important branch of medical practice. We are greatly indebted to Pearce Bailey for translating it and for his useful notes which will be of help to those who are less familiar with French medical traditions and organization. The translation is excellent since not only is Pearce thoroughly familiar with the language but had the assistance of his charming French wife.

ARTHUR D. MORRIS. *The Hoxton Madhouses.* March, Cambridgeshire, Goodwin Bros., 1958. [Pp. 50].

*Reviewed by* RICHARD A. HUNTER, *Psychiatric Registrar, The National Hospital for Nervous Diseases, Queen Square, London.*

IN this privately printed pamphlet—itself a rarity these days—Dr. Morris has written a fascinating account of the madhouses which flourished in and

about Hoxton in North London at the turn of the eighteenth century. He has combined his unrivalled knowledge of local medical history with wide reading in contemporary records, including the *Minutes of evidence taken before the Select Committee appointed to consider of provision being made for the better regulation of madhouses, in England,* 1815-16—the most informative and influential single document in the long struggle to humanize the condition of the insane poor in England—as well as little-known self-accounts of patients and the case involving James Parkinson, on whom he is an acknowledged expert. He has made this neglected chapter in the history of the insane exciting and essential reading not only for students of psychiatric history but medical historians in general who can no longer afford to pass lightly over this important branch of their subject.

HAROLD SPEERT. *Obstetric and Gynecologic Milestones. Essays in Eponymy.* New York, The Macmillan Company, 1958. ix, 700 pp. $15.00.

*Reviewed by* HERBERT THOMS, *Professor Emeritus of Obstetrics and Gynecology, Yale University School of Medicine.*

THE author of this book deserves praise for an excellent piece of historical writing, an accolade which does not extend to the publisher responsible for its presentation. The book is to be commended for its eminent usefulness to teachers and writers, for the author's extensive knowledge and acceptable style, and for its inspiring demonstration of high endeavor on the part of a busy practising physician.

The work was supported by the Department of Obstetrics and Gynecology of Columbia University. Medical history and medical history projects deserve this kind of support, for it is obvious that a knowledge of past performance is indispensable in scientific research. In fact, every research grant given to a medical school rightly should be taxed for the benefit of the school's library.

The medical historian perusing this book naturally will look for favorites and is not likely to be disappointed. For this reviewer, however, Adolph Pinard (1844-1934) who wrote a classic treatise on abdominal palaoptin (1878) deserves more emphasis, as does M. B. (not D.) Wright's contribution to the operation of version. Walter Channing's work on anesthesia and O. W. Holmes's coinage of the word are worthy of mention.

Dr. Speert has written an excellent book, a great credit to himself and vicariously to his alma mater, Johns Hopkins, where in a previous generation the writing of obstetric and gynecological history in this country was chiefly inaugurated by J. W. Williams and H. A. Kelly. Both would have welcomed this volume.

The typography of the book is obviously the responsibility of the publisher. It is neither pleasing nor worthy of the book's importance, and the price is too high. In spite of these things Dr. Speert's work is warmly

recommended to sit beside Garrison, Webster, Fowler, and other vade mecums of the medical teacher and writer.

FRANS JONCKHEERE. *Les Medécins de l'Égypte Pharaonique. Essai de Prosopographie.* Bruxelles, Fondation Egyptologique Reine Élisabeth, 1958. 172 pp., front., 19 plates.

*Reviewed by* MARTIN LEVEY, *The Institute for Advnced Study, Princeton, New Jersey.*

IT is unfortunate that the well-coordinated and long, fruitful work of Frans Jonckheere, a physician, with his teacher, Baudouin van de Walle, Professor of Egyptology in the Université de Liége, has come to an end with the former's recent death. Dr. Jonckheere was also an Egyptologist of the first rank which his translation of the Chester Beatty Papyrus as well as his other monographs and papers amply demonstrated.

Professor van de Walle prepared Jonckheere's last work for the press. In the form of a prosopographic list of physicians' names, the author created an "instrument de travail" in which much varied information may be found, particularly some hard-to-find references. Jonckheere unearthed almost all citations with the title *sinw*, physician, in the Egyptian literature of pharaonic times. He found one hundred, sixteen of which are anonymous. The transcriptions and hieroglyphs of the names are given as well as the physicians' titles, parents, and family, and location when possible. Following this general tabulation which occupies about half of the monograph, the medical men are then arranged chronologically.

That there was a hierarchization of medical practitioners in ancient Egypt is well brought out in various titles such as chief of physicians, inspector of physicians, director of physicians, and commandant of physicians, in increasing order of administrative importance. Other titles denoted professional specialization such as physicians for the eyes, abdomen, anus, and teeth. There were also physicians of various ranks in the royal palace, in the expeditionary corps, and in sacred establishments. Other titles of a doubtful nature are discussed as well as of those who were engaged in medical work but not properly qualified as physicians. Some of these may have been magical in nature.

Orthographic variants of the word *sinw* are considered as well as its grammatical forms and scribal errors. Gardiner, the well-known Egyptologist, prefers *swnw* for the Old Egyptian (3180-2240 B.C.) and Middle Egyptian (2240-1740 B.C.) texts; in Coptic, it is *saein*. These words, from the Egyptian which is a Hamito-Semitic language, are probably cognate to *asa* in Aramaic, *asya* in Syriac, *āsin* in Arabic (pl. *isā'*), and *asum* in Akkadian. These similarities together with related ideas found in northern and eastern Africa are deserving of further study, in part to determine the paths of transmission of prehistoric and early historic medicine.

In Egyptian, it is significant that there is no special word to indicate a surgeon as opposed to a physician who makes use of medicaments only. In Hammurabi's Code of ancient Mesopotamia (ca. 1725 B.C.), only the surgeon is mentioned. Although the surgeon's work as an artisan was controlled by the code, the physician as a dispenser of drugs was left unmentioned, indicating perhaps a higher social status which made him free of legislation. Although surgical literature is lacking in Mesopotamia, there is a plethora of medical prescriptions and allied material in both Sumerian and Akkadian cuneiform tablets.

Chapters on the social status of physicians and on iconography seem to be incomplete, perhaps due to the posthumous nature of the work. A brief supplement by M. H. De Meulenaere lists some overlooked iconographic items. There is no subject or name index.

Although this monograph is a very convenient compilation and may well serve the purpose of a quick reference as its author intended, it is a work which will be complementary in some ways to, but largely superseded by Grapow's now appearing multivolumed *Grundris der Medizin der Alten Ägypter.*

GEORGE E. ARRINGTON, JR. *A History of Ophthalmology.* Foreword by Felix Marti-Ibáñez, M.D. New York, MD Publications, (MD Monographs on Medical History), 1958. 174 pp. $4.00.

*Reviewed by* CLEMENT C. CLARKE, *Associate Clinical Professor of Ophthalmology, Yale University School of Medicine.*

A one-volume history of any kind is a good illustration of the second part of the motto of the irrepressible Sea Bees that "the difficult we do any time; the impossible takes a little longer." Dr. Arrington's 143 pages of text can hardly be described as a "History of Ophthalmology" in spite of the somewhat hyperbolic foreword by Felix Martí-Ibáñez, the editor of this new series of Monographs on Medical History. The most serious criticism of this book is its title.

In his preface Dr. Arrington gives as his reason for writing this book the desire to help the neophyte and the older physician (who is not lost in "the whirl of practice or research") to rekindle their humanitarianism and their inner peace of which world peace is but an extension. The author begins with "prehistorical ophthalmology" and proceeds in orderly fashion to the modern era. Within this chronological framework he expresses his ideas of how ophthalmology came to be, what its sources were, what its contributions to science and to society have been, what an impact the understanding of vision as a function has had upon the world, how important it is to leaven modern technology with broad cultural reading, how a study of history clarifies the past and illumines the future.

When the author illustrates the interest which seeing has stirred in thinking men of all ages and eras and how there has generally emerged a

branch of medicine concerned specifically with the elaborate techniques devised to deal with the organs of sight in terms of physiological understanding, pathological diagnosis, and therapeutic management, then this essay becomes interesting and stimulating.

But when Dr. Arrington tautologically belabors the obvious with the thesis that the study of history is vital to understanding, then stimulation becomes merely irritation. The irritative factor is increased by one's sympathy with many of his motives and ideas.

The book lacks the simplicity and modesty and clarity necessary in such a short text which can only sketch the outline of the author's concept of the history of ophthalmology but should also provide more competent directions for further study.

WU LIEN-TEH. *Plague Fighter. Autobiography of a Modern Chinese Physician.* Cambridge, England, Heffer and Sons, 1959. x, 667 pp. 30s.

*Reviewed by* G. H. WANG, *Department of Physiology, The University of Wisconsin, Madison.*

NEAR the end of 1910 a mysterious contagious disease broke out in North Manchuria which seemed to be the Black Death. Both Russia and Japan, wishing to divide Manchuria between themselves, threatened the Imperial Chinese Government to take the matter into their own hands if China did not put into effect measures for eradication of the disease. An energetic young civil servant in the Foreign Office of the Chinese Government, who received his higher education at Cornell University, found a young Chinese physician who was an M.D. of Cambridge University and who had been trained in bacteriological work in Germany and France. The Foreign Office sent this young physician to Harbin to investigate the epidemic. He succeeded in a short time in identifying the disease with pneumonic plague and worked out a plan to suppress it. With the support of the central and local governments of China and the help of physicians from other countries, the pneumonic plague was under control in four months. A possible disaster was averted. The young physician was Dr. Wu Lien-Teh, the author of the book under review.

Dr. Wu was born in Penang, Malaya. His father went from Taishan, Kwangtung, China, to Penang to seek his fortune. Like numerous emigrants from Kwangtung and Fukien provinces to Southeast Asia, he succeeded in carving out a comfortable living for himself and his family, and he did it entirely on his own intelligence and industry with some assistance from people of his clan and his district or province. Dr. Wu's portrait of his father is interesting. In the successful fight against plague in Manchuria, Dr. Wu rendered a very important service to China. His intelligence, training, acquaintance with Western ways, and freedom from the fetters of either Eastern or Western traditions, fitted him for this crisis. All of his subsequent work seems to be anticlimax.

The book may, however, have a larger meaning than the autobiography of one person. It illustrates one important fact. In introducing modern medicine into a country that has not had it before, the first stage is to train competent native physicians and surgeons, and the second stage is to establish medical research in the new country. It is only after the new country has competent workers in this sphere that modern medicine is successfully introduced. Dr. Wu seems to belong to the first stage. In spite of his having Gowland Hopkins as his tutor at Emmanuel College, Cambridge, and in spite of his having done some bacteriological work at Halle-an-der-Saal, and at Paris, he did little research, and almost nothing in promoting research in China. It is members of the generation following Dr. Wu's who have started research in the medical sciences in China. What is true with respect to medicine is also true of the sciences. No scientific research means no basis for industries. It is a point that should be constantly borne in the mind of everyone interested in elevating the living standard of underdeveloped countries nowadays.

The book is too long. It seems to be hastily written. A number of inaccuracies have crept in. Here only a few examples in names are given. The name of Dr. Wu's eldest son (Chang Keng) is sometimes given as Chang Kang. Na Tung's Tung should be the Chinese word which means "the Tung tree," but is given the character which means "east"; the Chinese family name, "Tai" (which means "respect") is wrongly represented by a character having a slightly different pronunciation which means "burden" and is never used as a family name. Dr. E. V. McCollum's family name becomes "McColl." The Johns Hopkins University is sometimes written as "The University of Johns Hopkins." Dr. Wu's rating of the faculty of the School of Hygiene and Public Health in that University in the twenties as below average is decidedly wrong and unjust!

ALCIDE GAROSI. *Siena nella storia della medicina (1240-1555)*. Firenze, Leo S. Olschki, 1958. XV, 570 pp., 36 pl. 15,000 lire.

*Reviewed by* DOROTHY M. SCHULLIAN.

THIS sumptuous volume on Siena's contribution to the history of medicine stops with the year 1555, when the city passed into the power of its neighbor and long-time rival, Florence. Relations in 1958 were happier, however, and the volume, published under the auspices of the University of Siena and with the financial assistance of Monte dei Paschi of Siena, was issued from the rival city. In its format it reflects the excellent taste and skilled craftsmanship of the publishing house of Olschki.

On the part of its author, who is a native not of Siena but of Magliano in Toscana, the work is a labor of love of several decades. It displays throughout the interests which claim him both as practising physician and as one who has long been active in the proceedings of medical historians in Italy. Part I presents in abundant detail and on documentary evidence

the hygienic and sanitary regulations of mediaeval Siena. If it be objected that building restrictions or decrees on street lighting, paving, and curfew fall only broadly within the scope of hygiene and sanitation, it cannot be gainsaid that they are necessary to our understanding of the mediaeval city and that the author sets forth realistically the everyday hygienic difficulties which faced the physician of that period. Part II deals more specifically with medicine and discusses in the first place the teaching of it, with attention to such eminent professors as Dino del Garbo, Francesco Casini, and of course Ugo Benzi; secondly, the practice of it, with an exhaustive treatment from pictorial evidence of the dress of physicians and with a list, arranged by praenomina, of 550 physicians, some distinguished and others mentioned only briefly in documents such as Siena's renowned *tavolette di Biccherna;* and thirdly, that one all-pervasive factor, the pest, which could interrupt teaching and practice and set at nought all the best efforts of physicians and municipal authorities.

The main part of the volume ends with some general conclusions and with lists of sources for the history of medicine which are available at the Archivio and the Biblioteca Comunale of Siena. These include manuscripts and incunabula, and also a large amount of later printed material. The bulk of this bears not on Siena to 1555, but on the history of medicine in general and for later periods. Some readers may question the wisdom of including these lists here and may also wonder why one of Italy's many eminent bibliographers was not requested to check them for consistency and accuracy; Celsus, e.g., is found under both Aulus and Celsus, and Petrus Hispanus is concealed under Liber medicinae, Libri di ricette, and Tesoro de' pouari. Appended are the texts, in Latin or Italian, of 119 documents used by the author in his narrative, together with a bibliography. There is no index of names, an undertaking which would have been extremely arduous and perhaps in the end unsatisfactory because of difficulties in identification. A loose leaf of Errata Corrige is furnished with the volume; many other errors, especially in foreign languages, remain uncorrected, as in a certain "very workmanlike book," recently reviewed in the *Times Literary Supplement,* which was "delightfully defaced by a stream of those malformations of proper names which crop up, not least in England, when a foreign language is in use."

The extent and thoroughness of the documentation, the minuteness with which the author has studied his sources, are amazing. They belie once more the theory, long since exploded, that practising physicians have no time for the history of medicine. The documentation is furnished not only in the appendix but also in the footnotes, which are printed in comforting fashion at the bottom of the pages, where they belong, and which become at times a deep morass of citations below a thin trickle of text. They range far beyond Siena itself, for the author compares or contrasts with conditions in Siena those in numerous other mediaeval cities. The volume would, in fact, have been considerably smaller had these additional

references been omitted; they support the author's conclusions, however, even if more frequently than need requires, and whoever works henceforth in the history of medicine of their period will need to take them into account. Histories of medicine for individual cities are, incidentally, issuing forth now with increasing frequency, and it is gratifying to be able to call attention here to the one for Milan, "La medicina a Milano fino al Seicento," which was prepared by Luigi Belloni and has recently been published in Volume XI, pages 595-696, of the *Storia di Milano* (Milano, Fondazione Treccani degli Alfieri). This general history of Lombardy's great center is a project of Senator Giovanni Treccani degli Alfieri, who was responsible for the *Enciclopedia italiana.*

Certain sections of Dr. Garosi's volume had already appeared in journals and are reprinted here with little change. This is true of the section on Ugo Benzi, following upon which the author takes extended notice, in tit-for-tat procedure, of the aspersions which were cast upon his earlier article by Dean Putnam Lockwood. Polemics between scholars are pathetic. In this case it was Lockwood who hurled the first stone, and this reviewer had hoped to bind up the wound by her remarks in the *Journal,* 1952, 7, 304-305. One feels a sadness that it has not healed. Lockwood's book on Benzi gave distress also to Arturo Castiglioni, but it seems clear that it could not have had great currency in Italy because the Biblioteca Comunale Ariostea in Ferrara, from whose manuscript Lockwood published Socino Benzi's biography of his father, possessed no copy until this reviewer, working there late in 1953, deemed it an obligation to present one.

The thirty-six plates provided by Dr. Garosi are elegantly reproduced and are distributed evenly throughout the volume. Some, like the title-pages from Highmore and Vesalius, bear only indirectly on the history of medicine at Siena. There are several, on the other hand, on both Pietro Lapini and Benzi, and the beautiful colored plates of the frescoes by Domenico di Bartolo in the Ospedale and of the paintings of Saints Cosmas and Damian in the Pinacoteca enhance the already valuable text. Only 450 copies of this volume were placed on sale; medical historians who wish to possess for themselves the evidence that Sienese physicians practised, as San Bernardino enjoined, "con carità, con fede, con cuore, con opera" will need to act quickly.

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